Electrical Energy and Natural Gas Requirements 1985 to 2005

1985 Feb.

SASKATCHEWAN POWER CORPORATION

Forecasting & Economic Analysis

(0286y)

TABLE OF CONTENTS

		Page
I.	FORECAST HIGHLIGHTS	
	A. Electrical Requirements	1
	B. Natural Gas Requirements	2
	C. Comparison to Last Year's Forecast	3
	D. Provincial Economy	4
	E. Conservation	6
	F. Load Management	8
	G. Rural Space Heating	8
	H. Significance of the Industrial Sector	8
	I. Large Consumers of Electricity in the Commercial Category	8
II.	ECONOMIC BACKGROUND TO THE FORECAST	
	A. Gross Domestic Product	10
	B. Population	10
	C. Households	11
	D. Farms	11
	E. Potash	12
	F. Oil Production	13
	G. Oil Pipeline Pumping	13
	H. Manufacturing	14
	I. Commercial	15
III.	ELECTRIC ENERGY FORECAST, 1985 TO 2005	
	A. Overview	16
	B. Relative Growth Among Sectors and Impact Upon Consumption Mix	23
	C. Sector Requirements	
	1. Residential	27
	a. Electric Space Heating	27
	b. Resorts	28
	c. Regular	28
	2. Farm	30
	a. Electric Space Heating	31
	b. Regular	32

TABLE OF CONTENTS continued

		Page
3.	Commercial	35
	a. General Service (excludes Oilfields)	35
	i. General Service II	35
	ii. General Service III	36
	iii. General Service IV Standard	37
	iv. General Service V	39
	b. Street Lights	40
4.	Industrial	40
	a. Potash Mining	42
	b. Anticipated New Load	42
	c. Oil Pipeline Pumping	42
	d. Iron and Steel	44
	e. Oilfields	44
5.	Bulk	44
6.	Saskatchewan Power Corporation Use	44
7.	System Losses	44
D.	Assessment of Confidence in the Forecast	45
IV.	NATURAL GAS REQUIREMENTS FORECAST, 1985 TO 2005	
A.	Overview	48
B.	Relative Growth Among Sectors and the Impact on Consumption Mix	55
C.	Sector Requirements	
1.	Residential	58
2.	Farms	59
3.	Commercial	59
4.	Industrial	61
5.	Speculative Load	63
6.	Power Plant Usage	63
7.	Other Saskatchewan Power Corporation Use	63
8.	Unaccounted For	65
9.	Alberta Contracts	65
D.	Confidence Interval Forecast	66
APPENDIX		
A-J.	Economic Background Papers	
K.	Load Forecasting with a Probabilistic Model	

TABLES

		Page
Table 1	Electrical Energy and Peak Load Forecast	17
Table 2	Historical Electrical Energy and Peak Load ..	18
Table 3	Forecast Average Electric Customers	19
Table 4	Historical Average Electric Customers	20
Table 5	Forecast Electric Use Per Customer	21
Table 6	Historical Electric Use Per Customer	22
Table 7	Distribution and Average Annual Rate of Electric Growth by Sector, 1974-84	24
Table 8	Distribution and Average Annual Rate of Electric Growth by Sector, 1985-95	25
Table 9	Distribution and Average Annual Rate of Electric Growth by Sector, 1995-2005	26
Table 10	Home Appliance Saturation Comparisons	30
Table 11	Farm Home Appliance Saturation Comparisons ..	33
Table 12	Farm Equipment Saturation Rate Comparisons ..	34
Table 13	General Service III by SIC	36
Table 14	General Service IV Standard by SIC	38
Table 15	General Service V by SIC	39
Table 16	Historical Industrial Electric Sales Growth 1974-1984	41
Table 17	Forecast Industrial Electric Sales Growth 1985-2005	43
Table 18	Total Electrical Requirements: Confidence Intervals 1990, 1995, 2005	45
Table 19	Electrical Energy and Peak Load Forecast, High, Most Likely, and Low	46
Table 20	Natural Gas Requirements Forecast	49
Table 21	Historical Natural Gas Requirements	50
Table 22	Forecast Average Natural Gas Customers	51
Table 23	Historical Average Natural Gas Customers	52
Table 24	Forecast Natural Gas Use Per Customer	53
Table 25	Historical Natural Gas Average Use Per Customer, 1974-1984	54
Table 26	Distribution and Average Annual Rate of Natural Gas Growth by Sector, 1974-1984 ...	56
Table 27	Distribution and Average Annual Rate of Natural Gas Growth by Sector, 1985-1995 ...	57
Table 28	Distribution and Average Annual Rate of Natural Gas Growth by Sector, 1995-2005 ...	57
Table 29	Residential Consumption of Natural Gas, 1974-2005	59
Table 30	Commercial Consumption of Natural Gas, 1974-2005	60
Table 31	Historical Growth In Industrial Natural Gas Sales, 1974-1984	62
Table 32	Forecast Growth In Industrial Natural Gas Sales, 1985-2005	64
Table 33	Alberta Natural Gas Requirements	66
Table 34	Total Natural Gas Requirements: Confidence Intervals 1990, 1995, 2005	66
Table 35	Natural Gas Load Forecast, High, Most Likely, and Low	68

FIGURES

		Page
Figure 1	Distribution of Electric Energy Requirements, 1974-2005	2
Figure 2	Distribution of Natural Gas, Requirements 1974-2005	3
Figure 3	System Net Recorded Peak Load, 1974-2005	4
Figure 4	Normalized Residential Gas Consumption Per Customer	6
Figure 5	Electric Residential Use Per Customer	7
Figure 6	Distribution of Electric Energy Requirements 1985, 1995, and 2005	23
Figure 7	System Net Recorded Peak Load, 1974-2005	47
Figure 8	Distribution of Natural Gas Energy Requirements, 1985, 1995, and 2005	55
Figure 9	Total Natural Gas Requirements	67

ELECTRICAL ENERGY AND NATURAL GAS REQUIREMENTS

Years	Electrical		Natural Gas		
	Energy	Net Peak (Seasonal)	Sask.	Alta.	Total
	(GW.h)	(MW)		(10^6 m^3)	
1974	6,874	1,247	2,618	677	3,295
1979	8,951	1,654	2,919	330	3,249
1980	9,203	1,773	2,847	296	3,143
1981	9,297	1,829	2,660	209	2,869
1982	9,680	1,800	2,914	243	3,157
1983	10,234	2,010	2,728	220	2,948
1984	11,272	2,095	2,855	238	3,093
		FORECAST*			
1985	11,630	2,200	2,942	241	3,183
1986	11,952	2,274	2,984	240	3,224
1987	12,398	2,359	3,037	240	3,277
1988	13,075	2,488	3,341	240	3,581
1989	13,484	2,565	3,426	240	3,666
1990	13,730	2,612	3,474	240	3,714
1991	13,995	2,663	3,496	240	3,736
1992	14,285	2,718	3,480	240	3,720
1993	14,596	2,777	3,525	240	3,765
1994	14,929	2,840	3,553	241	3,794
1995	15,231	2,898	3,535	242	3,776
2000	16,799	3,196	3,593	241	3,834
2005	18,521	3,524	3,759	241	4,000
		GROWTH RATES			
		(percent)			
1979-1984	4.72	4.84	(0.4)	(6.3)	(1.0)
1974-1984	5.08	5.33	0.9	(9.9)	(0.6)
1985-1990	3.38	3.50	3.4	0.0	3.1
1990-1995	2.10	2.10	0.3	0.1	0.3
1985-1995	2.73	2.79	1.9	0.0	1.7
1995-2005	1.97	1.97	0.6	0.0	0.6
1985-2005	2.35	2.38	1.2	0.0	1.1

*For more detail see Table 1, Page 17 (Electricity) and Table 21, Page 50 (Natural Gas). For the forecast range refer to Table 20, Page 49 (Electricity) and Table 35, Page 68 (Natural Gas).

1985 March 18

(0285y)

I. FORECAST HIGHLIGHTS

The annual forecast of electricity and natural gas requirements has been prepared using generally accepted utility practices. It is based upon our current assessment of the provincial economic outlook considering, particularly, population and household projections, industrial and commercial developments and, also, the impact of conservation. The forecast reflects only one possible scenario from which some variation can be expected as the future unfolds. Recognizing this likelihood, the forecast includes a range which should encompass future electrical and natural gas requirements.

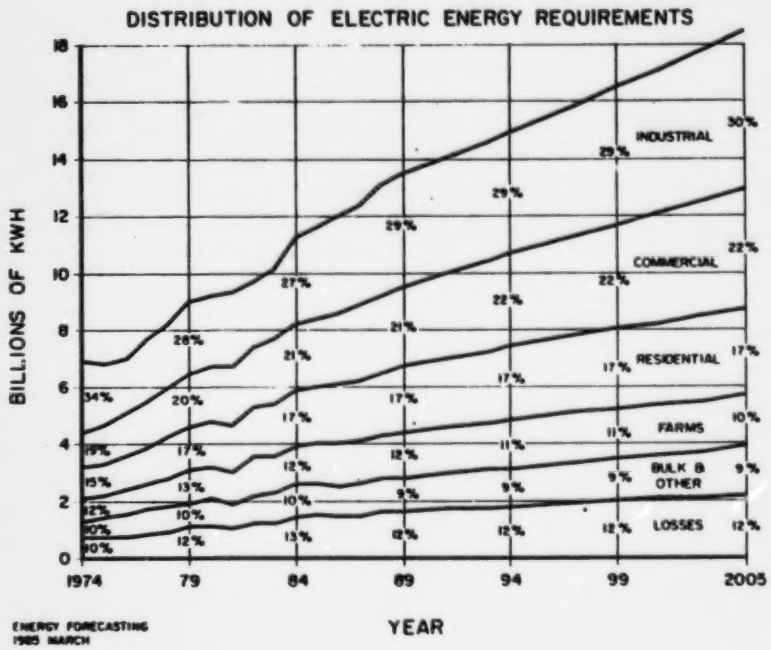
A. Electrical Requirements

Net recorded peak (seasonal) is forecast to grow from 2,200 MW in 1985/86 to 2,612 MW in 1990, 2,898 MW in 1995, and 3,524 MW in 2005. This represents compound annual growth rates of 3.5, 2.8, 2.0, and 2.4 percent for the periods 1985/86 to 1990/91, 1985/86 to 1995/96, 1995/96 to 2005/06, and 1985/86 to 2005/06, respectively. By comparison, net recorded peak load grew at compound rates of 4.8 percent during the past five years and 5.3 percent during the past ten years. As a further comparison, the average absolute increase per year over the past ten years was 84.8 MW compared to the forecast of 69.8 MW per year between 1985 and 1995.

Total electrical energy requirements are forecast to increase from 11,630 GW.h in 1985 to 13,730 GW.h in 1990, 15,231 GW.h in 1995, and 18,521 GW.h by 2005. This represents compound growth rates of 3.4, 2.7, 2.0, and 2.4 percent for the periods 1985-90, 1985-95, 1995-2005, and 1985-2005. By comparison, the total energy requirements grew at rates of 4.7 percent during the past five years and 5.1 percent during the past ten years. As a further comparison, the average annual increase per year over the past ten years was 440.4 GW.h compared to the forecast of 360.1 GW.h per year between 1985 and 1995.

During the past ten years, the most rapidly growing sectors were commercial, residential, and industrial together accounting for 60 percent of the growth. During the next ten years the industrial sector is forecast to make up almost 31 percent of all growth. The residential, farm, and commercial sectors account for 52 percent of the growth. Energy growth in the various end-use sectors is shown in Figure 1.

Figure 1



B. Natural Gas Requirements

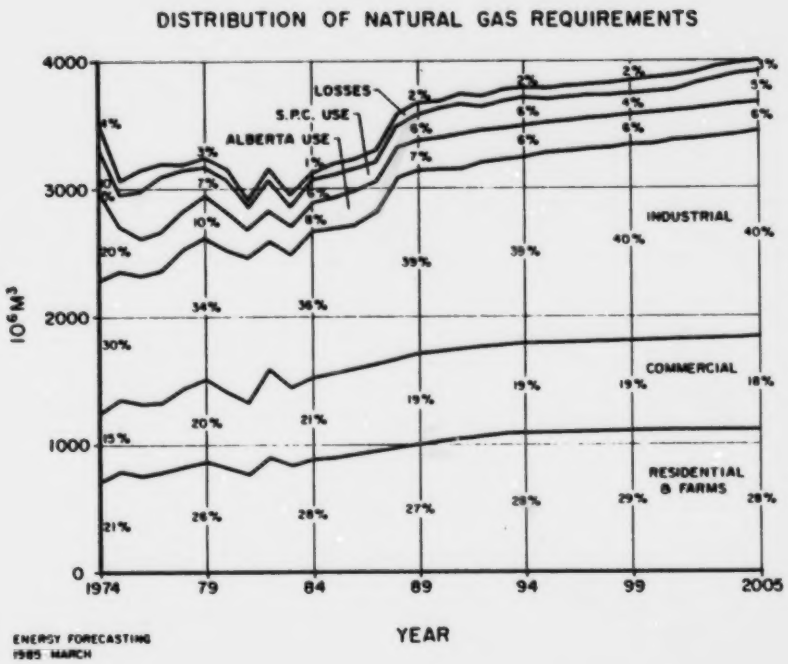
Total provincial natural gas requirements are forecast to increase from 2,942 10^6 m^3 in 1985 to 3,535 10^6 m^3 by 1995 and 3,759 10^6 m^3 by 2005. Annual rates of growth are forecast to be 1.7 percent for 1985 to 1995 and 0.6 percent for 1995 to 2005, with an overall annual growth rate of 1.1 percent for the forecast period.

Consumption in the residential, commercial, and industrial sectors all grew strongly during the past decade. Reduced consumption by power plants partially offsets this growth.

Growth during the next ten years is primarily due to adding a heavy oil upgrader in 1988, expanding potash production, and the Saskatchewan Natural Gas Distribution Program.

Alberta requirements, consisting primarily of the City of Medicine Hat, will decline to about 7.4 percent (1985) - 5.8 percent (2005) of total Saskatchewan consumption. Growth in natural gas requirements by various end users is shown in Figure 2.

Figure 2

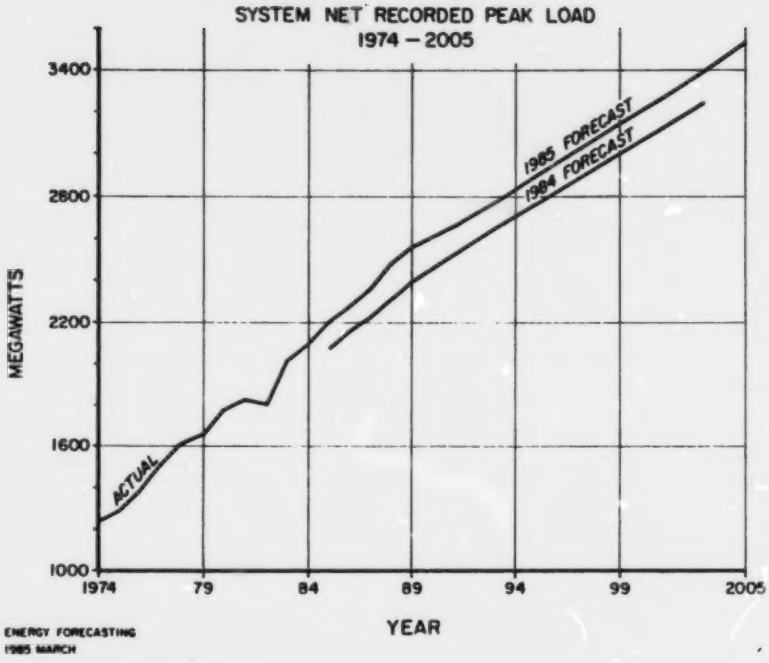


C. Comparison to Last Year's Forecast

Electrical requirements in 1984 grew substantially. Electrical energy was up almost 10 percent and peak load 4 percent over 1983. Over 48 percent of the increase was by Oilfields and General Service VI customers. In addition, system losses were assumed in the 1984 forecast to be 12 percent of total requirements while in fact they were almost 13 percent.

The electric load forecast has been raised from the 1984 forecast. The 1985 electric forecast has been increased by 152 MW in 1990, 135 MW in 1995, and 153 MW in 2004. The 1985 gas forecast is almost unchanged from that of the previous year. A comparison of the 1984 and 1985 peak load forecast is shown in Figure 3.

Figure 3



D. Provincial Economy

The current forecast for the provincial economy is made against a background of moderate inflation, slowly declining interest rates, low commodity prices, stiff competition on world markets but growing concern about protectionist measures.

Most forecasters expect Saskatchewan's economy to bounce back from the drought-affected level of 1984 which, in fact, witnessed strong performances in the production of potash, oil and steel, all of which impact significantly on SPC operations. Beyond 1985, assuming average crops, economic growth, as measured by estimates of Real Domestic Product, is expected to be moderate for the next five years. Among available forecasts, The Conference Board predicts an average annual rate of 2.6 percent; Informetrica, 3.9 percent; the Planning Bureau, 3.6 percent all for the period 1984 to 1989 while the Royal Bank projects 2.9 percent annual growth between 1983 and 1988 and 3.3 percent from 1988 to 1993. Informetrica's longer-term forecast looks for annual growth of 2.6 percent in the period 1990 to 2005.

Agriculture is expected to remain relatively weak but the financial problems facing farmers should ease as interest rates come down and inflation remains low. As a result, the decline in farm numbers, which has been going on since the 1940's, is expected to moderate and eventually level out. Saskatchewan's population is forecast to grow quite strongly in the next few years, particularly if the heavy oil upgraders proceed, but slow appreciably in the 1990's, reaching 1,125,000 in the year 2000 and 1,150,000 in 2005. The number of households will be affected by the aging of the population which results in many people spending their later years living alone. Total households are expected to increase 11 percent in the next ten years and 20 percent by the year 2005. Apartments and flats could account for about 18 percent of total households in 2005.

Potash production increased dramatically in 1984, far exceeding all known predictions to reach 7.6 million tonnes. Production has remained high in the early months of 1985 but a combination of high inventories, softer markets and competition from new mines is expected to drop production by about 500,000 tonnes or possibly more. It is expected that surplus capacity will exist for several years but Saskatchewan, with the best and most extensive potash reserves in the world and some of the most efficient mines, should slowly recover with production reaching 8.2 million tonnes in 1990, 10.6 million tonnes in 2000 and 11.9 million tonnes in 2005.

Oil production also increased beyond expectations in 1984 and, with demand holding up, particularly for heavy Lloydminster crudes, and production buoyed by the record pace of drilling activity, total output in 1985 should reach 11.2 million cubic metres. The current forecast calls for production to peak at about 12 million cubic metres in 1987 before declining slowly but if drilling is sustained at current levels that peak could be higher and the commencement of decline set back.

Electricity requirements for oil pipeline pumping were higher than forecasted in 1984 owing to higher production in both Alberta and Saskatchewan, strong demand for oil and oil products in the United States and the high proportion of heavy oils moved. Forecasts of production are more optimistic than they were last year with synthetic oil replacing much conventional oil over the forecast period and being supplemented by production from Norman Wells and, eventually, the MacKenzie Delta.

The steel industry was yet another major sector of the economy which fared better than expected in 1984. The outlook is for modest growth in the next few years in the face of keen competition from low-cost offshore producers.

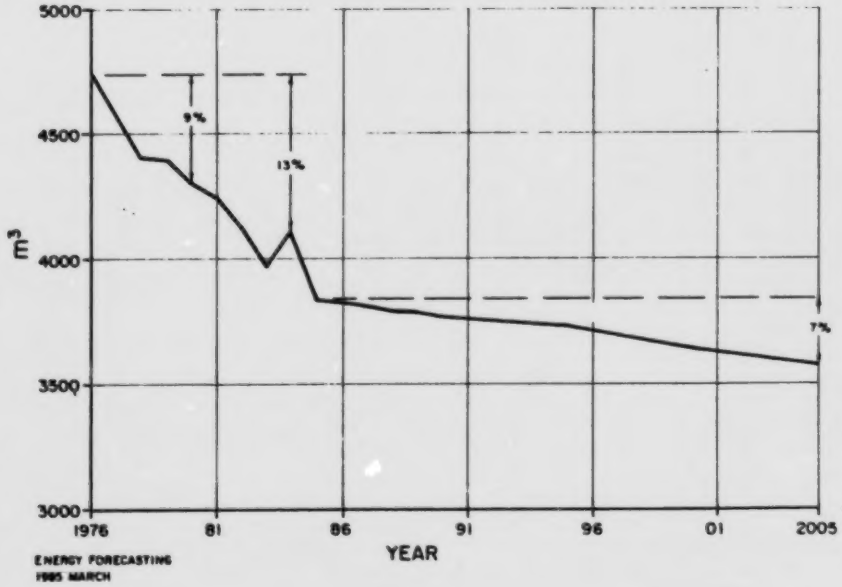
New developments include a possible new paper mill at Prince Albert, development of aspen resources in the longer term, a small potassium sulphate operation and, of course, the heavy oil upgraders at Regina and Lloydminster.

E. Conservation

Since the mid-1970's the average per residential customer consumption of natural gas has decreased. This has been the result of greater amounts of insulation in both new and existing buildings. As shown in Figure 4, this trend is forecast to continue due to both more efficient housing and furnaces. However, the rate of decrease in average customer consumption is expected to ease significantly in future years. Conservation efforts over the past ten years have been substantial and future natural gas rate increases will not be as steep as those in the past. The withdrawal of government assistance and public awareness programs will also have an impact in reducing future conservation efforts in the residential sector.

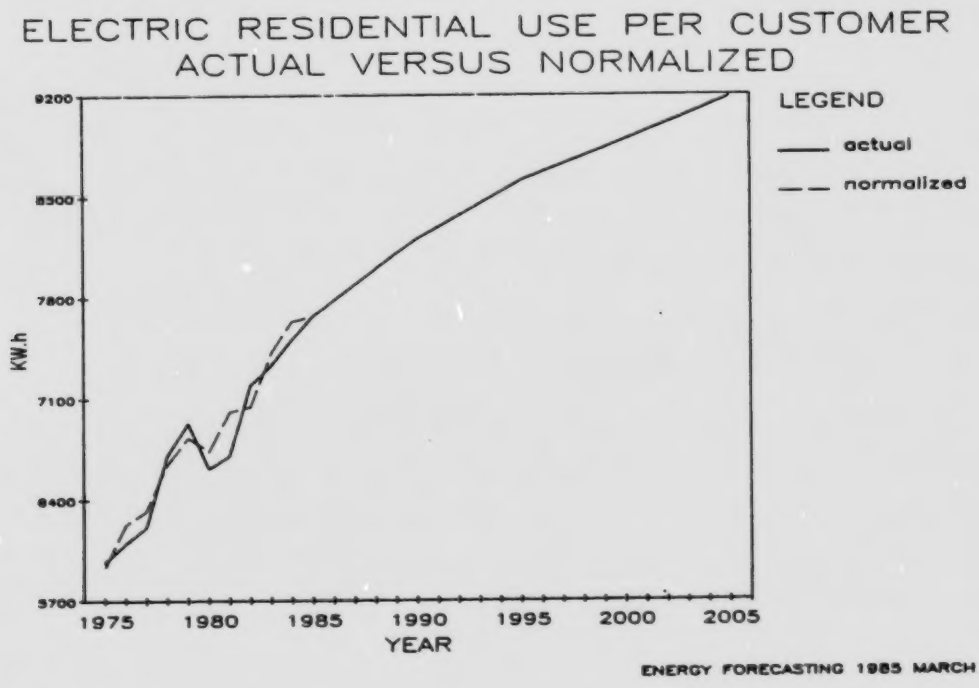
Figure 4

NORMALIZED RESIDENTIAL GAS CONSUMPTION PER CUSTOMER
HISTORICAL & FORECAST CONSERVATION IMPACT



Manufacturers of electrical appliances and lighting equipment have and are expected to continue to improve the efficiency of their consumption products. This may at least partially explain the slowing in the growth of average residential electrical consumption per customer in recent years. It also supports the forecast of a continuation of this trend. Figure 5 shows the historic actual and normalized consumption as well as expected electrical consumption per residential customer

Figure 5



Finally, some improvement in energy efficiency is expected to continue in the potash industry. This is reflected in both the electric and natural gas forecasts by slight declines in energy requirements per tonne of potash produced.

F. Load Management

Load management is essentially the shifting of customer loads from peak demand periods to times in the day when load levels are lower. This reduces the amount of generating capacity (MW) that the utility has to install and allows for more effective use of base loaded generating plants. Through agreement with three industrial customers, their power demands are reduced at times of peak demand. The amount of the load reduction is expected to reach 142 MW by 1995.

G. Rural Space Heating

Currently, there are about 69,000 farm and rural houses without access to natural gas. There are approximately 19,000 farms and 3,100 rural homes yet to be served under the Saskatchewan Natural Gas Distribution Program. About 6,000 farms are forecast to connect to electric space heating during the next 20 years. This will double the current number.[1] The remaining homes will remain on fuel oil or propane.

H. Significance of the Industrial Sector

During the next ten years, increased industrial consumption is forecast to account for about 31 percent of the total growth in electric consumption and 41 percent of the total growth in the consumption of natural gas. Increased consumption by oilfields and the potash industry is particularly significant accounting for over 44 percent of the increase in industrial electrical consumption and 88 percent of the increase in industrial natural gas consumption (including a heavy oil upgrader).

I. Large Consumers of Electricity in the Commercial Category

The following table gives a distribution of commercial (15-7,500 kW) consumption by standard industrial classification (SIC). This sector currently accounts for about 20 percent of the electrical energy requirements.

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[1]Billing statistics indicate that there are currently about 12,200 residential and farm customers using electricity as their primary source of space heating.

COMMERCIAL CONSUMPTION BY SIC

Division	Percent of Total		
	15-75 kW	75-1,000 kW	1,000-7,500 kW
Community, Business, & Personal Service	37.9	27.2	11.2
Trade	28.5	19.8	5.7
Transportation, Communications, & Other Utilities	13.2	13.0	29.7
Finance & Real Estate	9.0	11.9	8.5
Public Administration & Defense	4.9	8.9	3.4
Manufacturing	4.0	11.4	18.6
Other	2.5	7.8	22.9
TOTAL	100.0	100.0	100.0

II. ECONOMIC BACKGROUND TO THE FORECAST

A. Gross Domestic Product

Estimates of Gross Domestic Product (GDP) are the closest indicator we have to a measure of the value of total goods and services produced in a province. The Conference Board deflates its estimates to real 1971 dollars and publishes estimates on an industry basis. The Board's 1985-January forecast for Saskatchewan is shown in Table A-1 in the Appendix.

Little growth is shown for 1984 due to the sharp decline in agricultural output although most other sectors of the economy performed quite well, particularly mining and manufacturing. Between 1984 and 1989, total GDP is forecasted to rise 13.9 percent or 2.6 percent annually on average. Goods-producing industries, which are generally considered to be energy-consuming, are forecasted to climb 18.5 percent or 3.5 percent annually but this rate is misleading owing to the poor agricultural year in 1984. Service-producing industries, which correspond quite closely to the commercial sector, are predicted to increase 11.3 percent in this period or 2.2 percent annually.

Estimates and forecasts from the Planning Bureau indicate a decline of 3.6 percent in Saskatchewan's 1984 GDP followed by an increase of 19 percent in the period to 1989. Slow growth is forecasted for the period 1989 to 1994 with total GDP climbing 6.5 percent or 1.3 percent annually. The non-agricultural industries are forecasted to grow at an average annual rate of only 0.7 percent.

B. Population

On 1984 October 01, Saskatchewan's population stood at 1,010,900, an increase of 14,000 or 1.4 percent in the previous twelve months. Natural increase accounted for 9,100 persons and net migration for 5,000. By contrast, Alberta suffered a net migration loss of 40,200 persons which suggests that some of the people who moved to Alberta from Saskatchewan and other provinces in the late 1970's and early 1980's are returning home in search of employment. More recent estimates place Saskatchewan's population at 1,016,400 on 1985 January 01.

The ten-year forecast by the Planning Bureau looks for continued strong growth in population, averaging 1.1 percent, for the remainder of the 1980's but then slowing to about half that rate by 1993. This assumes a net inflow of people attracted by employment

prospects created by the construction of heavy oil upgraders in Saskatchewan in the next few years followed by a resumption of historical patterns in which the province either barely retains its natural increase or experiences a small net loss through migration. In the subsequent period to 2005, the population is again forecasted to grow at an average rate of just under 0.5 percent, reaching 1,125,000 in the year 2000 and 1,150,000 in 2005.

More than 12 percent of the population in 1984 were 65 years of age or over and this proportion is likely to increase in the forecast period which may affect the size and type of households in Saskatchewan.

C. Households

The forecast and historical time series of households (or occupied dwellings) has been revised to conform with current Statistics Canada estimates of the housing stock. The number of occupied dwellings is larger than shown in previous forecasts mainly owing to lower estimates of vacant dwellings in Saskatchewan.

The forecast is based on the population forecast and is subject to considerable deviation from year to year. The average size of household is based on a forecast by CMHC in 1979 and may err on the high side in view of the aging population and the growing number of one and two person households. Total households are forecast to climb from 362,500 in 1984 to 402,000 in 1994, an increase of 11 percent; 421,000 in 2000 and 435,000 in 2005. Apartments and flats were estimated at 53,000 in 1984, about 14.6 percent of the total and are forecast to rise to 78,000 or 18 percent of total households, by 2005.

D. Farms

Statistics Canada estimates place the number of census farms in Saskatchewan at 66,400 in 1984. This represented a decline of 0.4 percent from 1983. The number of farms has been declining for over 40 years now (there were 138,713 farms in 1941) and is forecasted to continue declining, though at a slowing rate, for the forecast period. The current forecast looks for 63,160 farms in 1994, 61,975 in 2000, and 61,360 in 2005.

Financial problems are expected to continue plaguing Saskatchewan farmers owing to the combination of rising costs and low commodity prices. The Planning Bureau forecast does not envisage significant improvement in net farm income in the next ten years though there should be a large increase this year over the drought-affected income of 1984. If incomes fail to improve, the rate of farm consolidation may increase and accelerate the rate of decline in farm numbers forecast but it is more likely that farmers will try to stay afloat through off-farm work to supplement farm incomes. While the traditional crops will continue to dominate there will be increased acreage devoted to specialty crops. Irrigation of crops, grains as well as specialties, is expected to increase substantially.

E. Potash

Potash production established a new record level of 7.65 million tonnes K_2O in 1984; an increase of 29 percent over 1983 and 4.8 percent greater than the previous high of 7.3 million tonnes, produced in 1980. Potash sales fared quite well too with a total of 7.03 million tonnes, 2.5 million tonnes of which went to offshore markets. Nevertheless, the addition to inventories was substantial and year-end inventories stood at close to 1.5 million tonnes which might retard production in 1985.

World consumption of potash fertilizers is expected to grow at an annual rate of about 3 percent over the next ten years and be particularly strong in Latin America and Asia. These are markets in which Saskatchewan producers have competed successfully in recent years but, in future, there will be stiffer competition from mines in New Brunswick, Jordan, Israel, and the U.S.S.R. As a result, most forecasters expect Saskatchewan potash production in 1985 to fall back from last year's level and not recover until about 1988. This is on the assumption that mines in New Brunswick and Jordan, which experienced start-up problems in 1984, reach satisfactory levels of production in 1985.

The expansion at Lanigan is expected to be completed in 1985 but full utilization of capacity may not be achieved until 1990. Kalium's expansion should be complete in 1986. No other expansions have been announced but one is possible at Central Canada's operation.

The current "most likely" forecast looks for production to remain at about 7.7 million tonnes in 1985 and then increase slowly to 8.5 million tonnes in 1990 and 9.3 million tonnes in 1995. There is a strong possibility, however, that production will fall at least 500,000 tonnes in 1985 before recovering slowly to 8.2 million tonnes on 1990.

F. Oil Production

Oil production in 1984 surpassed all expectations to reach 10.8 million cubic metres, an increase of 13 percent over 1983. Refiners' nominations have consistently exceeded producibility for most types of Saskatchewan crude and, with demand particularly strong in the United States, this state of affairs is likely to continue for at least another two or three years. Productive capability was raised in 1984 owing to the record number of oil well completions (2,125) and the hectic pace of drilling in the early weeks of 1985 suggest that capability will increase again this year.

The shut-in problems experienced in January were temporary and demand should remain strong as long as prices move to meet the market. The current forecast is more optimistic than that of last year and calls for production to climb to about 11.96 million cubic metres by 1987; to remain close to that level for about four years and then decline slowly to 11.5 million cubic metres in 1995, 10.6 million cubic metres in 2000, and 9.5 million cubic metres in 2005. While the emphasis will shift to the production of heavy oils in the Lloydminster and Kindersley areas, production of light and medium oil from the Estevan-Weyburn area will hold up better and longer than was expected until quite recently. Production from the south-west, however, is forecast to decline throughout the period.

G. Oil Pipeline Pumping

Strong demand for western Canadian crude oil and refined petroleum products, particularly in the United States, pushed pipeline capacities to the limit in 1984 and caused IPL to announce a major expansion program to raise capacity in two stages. The first, scheduled for completion in late-1985, will add 12,000 m^3/day through the addition of one pumping station in Alberta and six in Saskatchewan. A second stage will add a further 24,600 m^3/day by the end of 1986.

Part of the problem is that much of the increased demand has been for higher viscosity heavy crudes which reduce the capacity of the line in terms of light crude. Presumably the pipeline capacity problems will ease when the expansions are completed and with the conclusion of the major highway resurfacing program in the northern United States. Also, by the end of the 1980's, one or both of the heavy oil upgraders should be in place. But while the flow of light Alberta crude oil is likely to decline as producibility falls, it will be higher than indicated in last year's forecast and will be supplemented by synthetic oil and by new supplies from Norman Wells and, later on, possibly the MacKenzie Delta. For the next two or three years at least, however, there should be a ready market in the northern tier states for heavy oil provided that dilutents are available for pipeline transportation.

The other major variable in oil flows is demand for petroleum products. In Canada, consumption of refined products fell more than 20 percent between 1979 and 1983 but there seems to have been a levelling out in 1984. No significant increase in demand is expected in Canada in the forecast period but, as indicated, demand for Canadian oil and products is expected to remain strong in the United States. Rather than declining slowing but steadily, as forecasted last year, it now seems that oil flows will be maintained at current levels or even increase marginally in the next few years before beginning to decline in the 1990's. Excluding refined products, oil flows through the IPL system should be about the same in 1995 as they were in 1984 but may fall by 8 to 10 percent in the next ten years.

H. Manufacturing

Manufacturing production recovered quite well in 1984. Value of shipments was up by 10.2 percent in current dollars, over 1983. The Conference Board estimates show a 5.8 percent increase in the manufacturing component of GDP and Board forecasts indicate a 14 percent growth between 1984 and 1989.

Future levels of activity will be affected considerably by decisions on the heavy oil upgraders. Excluding the upgraders, investment in manufacturing is expected to be quite modest in the next nine or ten years. IPSCO experienced strong growth in 1984 with good sales to the oil and gas industry and by diversifying its products. Prospects for oil and gas well drilling are at least as good in 1985 as they were in 1984 and with steel sales in the United States continuing to do well IPSCO should enjoy another good year though

production of steel ingots may be down slightly. Foreign pipe and other products have been making inroads into the western Canadian market, however, and competition for markets is keen. Moderate growth for IPSCO is forecasted for the next five years.

For the pulp and paper industry, 1984 was generally a good year for Canadian producers but new investments will be needed if the industry is to remain competitive in the face of fierce competition. In Saskatchewan, the short-run outlook is not too promising but a new paper mill in the Prince Albert area is a possibility.

I. Commercial

The commercial sector of the economy is assumed to be represented by the service-producing industries in estimates and forecasts of Real Domestic Product by The Conference Board (see Table A-1).

The Economic Council of Canada last year described the service sector as "a major vehicle of economic growth" and growth has been quite strong in recent years. Between 1974 and 1984, the service sector RDP in Saskatchewan rose by 39 percent or 3.3 percent annually. Continued growth is forecasted but at slower rates, averaging 1.7 percent in the next ten years and 1.6 percent between 1995 and 2005.

III. ELECTRIC ENERGY FORECAST, 1985 TO 2005

A. Overview

Annual electrical energy requirements (Table 1) are forecast to increase from 11,630 GW.h in 1985 to 15,231 GW.h by 1995 and 18,521 GW.h by 2005. This represents average annual growth rates of 2.7 and 2.0 percent, for the periods 1985-95 and 1995-2005, respectively. Factors contributing to the forecasted slowing rate of growth are a slowing of population growth after 1990, conservation, and appliance saturation.

Based on the forecast of annual electrical energy requirements, peak load is calculated for the forecast period assuming a constant 60 percent annual load factor. Peak load (net of interrupted industrial load) is forecast to increase from 2,200 MW in 1985 to 2,898 MW by 1995 and 3,524 MW by 2005. This represents average annual growth rates of 2.8 and 2.0 percent, for the periods 1985-95 and 1995-2005, respectively.

By comparison, the annual electrical energy requirement (Table 2) increased at an average annual compound rate of 5.1 percent from 6,868 GW.h in 1974 to 11,272 GW.h in 1984. During this same period, peak load grew from 1,247 MW to 2,095 MW (5.3% per year). Tables 3 to 6 contain historic and forecasted data on the average number of electric customers and electric use per customers.

Table 1

ELECTRICAL ENERGY AND PEAK LOAD FORECAST

(1985 - 2005)

ENERGY REQUIREMENT (millions of kW.h)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-1990	% Growth 1985-1995
END-USE SECTOR													
Residential	2,018.1	2,081.9	2,150.5	2,220.1	2,290.8	2,344.3	2,392.1	2,448.6	2,497.5	2,547.0	2,597.6	3.04	2.56
Farms	1,408.4	1,443.6	1,479.7	1,516.7	1,554.6	1,593.5	1,617.4	1,641.7	1,666.3	1,691.3	1,716.6	2.50	2.00
Commercial	2,450.1	2,549.1	2,649.1	2,750.3	2,847.0	2,944.5	3,037.1	3,130.2	3,224.0	3,318.3	3,409.3	3.74	3.36
Industrial	3,184.1	3,328.1	3,507.1	3,829.4	3,947.7	3,949.0	3,992.9	4,052.1	4,136.0	4,233.4	4,306.6	4.40	3.07
Bulk & SPC	1,098.3	1,128.9	1,162.8	1,199.5	1,225.5	1,251.3	1,276.3	1,300.2	1,322.8	1,349.6	1,375.3	2.64	2.27
Losses	1,471.1	1,420.7	1,449.3	1,558.7	1,618.1	1,647.7	1,679.5	1,712.2	1,749.6	1,789.5	1,825.7	2.29	2.18
TOTAL REQUIREMENT	11,630.0	11,952.3	12,398.4	13,074.8	13,483.7	13,730.3	13,995.3	14,285.0	14,596.1	14,929.1	15,231.1	3.38	2.73
% Change		2.77	3.73	5.46	3.13	1.83	1.93	2.07	2.18	2.28	2.02		
PEAK DEMAND (MW) (Seasonal)													
Potential Peak	2,323.0	2,403.0	2,501.9	2,633.6	2,711.4	2,762.3	2,816.7	2,874.8	2,938.0	3,005.4	3,065.8	3.52	2.81
Interrupted Load	123.0	129.0	143.0	146.0	146.0	150.0	154.0	157.0	161.0	165.0	168.0	4.05	3.17
NET PEAK	2,200.0	2,274.0	2,358.9	2,487.6	2,565.4	2,612.3	2,662.7	2,717.8	2,777.0	2,840.4	2,897.8	3.50	2.79
% Change		3.36	3.73	5.47	3.13	1.83	1.93	2.07	2.18	2.28	2.02		

ENERGY REQUIREMENT (millions of kW.h)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
END-USE SECTOR												
Residential	2,640.0	2,691.5	2,735.0	2,778.9	2,823.4	2,868.3	2,913.8	2,959.8	2,997.4	3,044.4	1.60	2.08
Farms	1,726.9	1,737.3	1,747.7	1,758.2	1,768.8	1,779.4	1,790.1	1,800.8	1,811.6	1,822.5	0.60	1.30
Commercial	3,481.4	3,554.0	3,627.2	3,700.9	3,775.1	3,849.9	3,925.2	4,001.1	4,077.4	4,154.3	2.00	2.68
Industrial	4,425.2	4,533.2	4,655.6	4,782.7	4,915.5	5,052.5	5,186.6	5,330.2	5,476.2	5,626.7	2.71	2.89
Bulk & Other	1,402.1	1,427.7	1,454.6	1,479.7	1,502.5	1,526.5	1,559.5	1,589.6	1,621.8	1,652.3	1.85	2.06
Losses	1,862.6	1,899.2	1,936.8	1,975.0	2,013.9	2,053.6	2,094.3	2,136.1	2,177.4	2,220.5	1.98	2.08
TOTAL REQUIREMENT	15,538.2	15,843.0	16,156.9	16,475.4	16,799.2	17,130.2	17,469.5	17,817.6	18,161.8	18,520.8	1.97	2.35
% Change	2.02	1.96	1.98	1.97	1.97	1.97	1.98	1.99	1.93	1.98		
PEAK DEMAND (MW) (Seasonal)												
Potential Peak	3,124.3	3,182.0	3,242.0	3,302.6	3,364.2	3,427.2	3,491.7	3,557.9	3,623.4	3,691.7	1.88	2.34
Interrupted Load	168.0	168.0	168.0	168.0	168.0	168.0	168.0	168.0	168.0	168.0	0.00	1.57
NET PEAK	2,956.3	3,014.3	3,074.0	3,134.6	3,196.2	3,259.2	3,323.7	3,389.9	3,455.4	3,523.7	1.97	2.38
% Change	2.02	1.96	1.98	1.97	1.97	1.97	1.98	1.99	1.93	1.98		

NOTE: Totals subject to rounding

1985 March 18
(0285y)

Table 2

HISTORICAL ELECTRICAL ENERGY AND PEAK LOAD

(1974 - 1984)

ENERGY REQUIREMENT (millions of kW.h)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	% Growth 1979-84	% Growth 1974-84
END-USE SECTOR													
Residential	1,018.1	1,118.5	1,187.3	1,296.0	1,447.2	1,537.0	1,562.3	1,587.1	1,773.7	1,836.4	1,941.6	4.78	6.67
Farm	794.9	864.1	922.7	978.2	1,063.6	1,139.4	1,131.0	1,126.9	1,319.7	1,335.3	1,372.7	3.80	5.61
Commercial	1,334.9	1,445.1	1,519.9	1,597.3	1,676.8	1,830.8	1,946.8	2,066.4	2,120.3	2,243.5	2,354.2	5.16	5.83
Industrial	2,363.8	1,970.8	1,947.5	2,278.8	2,285.0	2,477.0	2,567.9	2,559.1	2,218.5	2,555.1	3,052.5	4.27	2.59
Bulk & SPC Use	666.0	712.7	754.1	790.4	831.2	873.1	918.6	950.8	1,014.5	1,038.5	1,111.6	4.95	5.26
Losses	690.3	655.8	716.1	800.0	926.6	1,093.4	1,076.0	1,006.4	1,233.3	1,225.6	1,439.1	5.64	7.63
TOTAL REQUIREMENT	6,868.0	6,767.0	7,047.6	7,740.7	8,230.4	8,950.7	9,202.6	9,296.7	9,680.0	10,234.4	11,271.7	4.72	5.08
% Change	3.6	(1.5)	4.1	9.8	6.3	8.8	2.8	1.0	4.1	5.7	10.1		
NORMALIZED REQUIREMENT		6,779.3	7,176.3	7,833.3	8,173.4	8,888.7	9,292.9	9,664.8	9,472.0	10,265.4	11,396.0	5.10	
ACTUAL DEGREE DAYS (°C)	6,033	5,966	5,477	5,485	6,038	6,165	5,526	4,988	6,294	5,660	5,550		
PEAK DEMAND (MW)													
Potential Peak	1,262.0	1,291.0	1,468.0	1,606.0	1,612.0	1,724.0	1,858.0	1,957.0	1,800.0	2,099.0	2,099.0	4.01	5.22
Interrupted Load	15.0	0.0	84.0	84.0	4.0	70.0	85.0	108.0	0.0	89.0	4.0		
Net Peak	1,247.0	1,291.0	1,384.0	1,522.0	1,608.0	1,654.0	1,773.0	1,829.0	1,800.0	2,010.0	2,095.0	4.84	5.32
% Change	0.4	3.5	7.2	10.0	5.7	2.9	7.2	3.2	(1.6)	11.7	4.2		

NOTE: Excludes Export.
1985 March 18
((illegible))

Table 3

FORECAST AVERAGE ELECTRIC CUSTOMERS

(1985 - 2005)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-90	% Growth 1985-95
Residential	263,000	267,500	272,500	277,500	282,500	285,500	288,500	292,500	295,500	298,500	501,500	1.66	1.38
Farm	72,500	72,800	73,100	73,400	73,700	74,000	74,300	74,500	74,700	74,900	75,100	1.41	0.35
Commercial	46,512	46,993	47,474	47,955	48,286	48,617	48,798	48,979	49,160	49,341	49,522	1.89	0.63
Industrial	904	929	954	960	965	970	975	980	985	990	995	1.42	0.96
Total Bulk & SPC Use	632	637	642	647	652	657	662	667	672	677	682	0.78	0.76
Total System	383,548	388,859	394,670	400,462	406,103	409,744	413,235	417,626	421,017	424,408	427,799	1.33	1.10

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
Residential	304,500	308,500	311,500	314,500	317,500	320,500	323,500	326,500	328,500	331,500	0.95	1.16
Farm	75,300	75,500	75,700	75,900	76,100	76,300	76,500	76,700	76,900	77,100	0.26	0.31
Commercial	49,618	49,714	49,810	49,906	50,002	50,098	50,194	50,290	50,386	50,482	0.19	0.41
Industrial	1,001	1,006	1,011	1,016	1,021	1,026	1,031	1,036	1,041	1,046	0.50	0.73
Total Bulk & SPC Use	687	692	697	702	707	712	717	722	727	732	0.71	0.74
TOTAL SYSTEM	431,106	435,412	438,718	442,024	445,330	448,636	451,942	455,248	457,554	460,860	0.75	0.92

1985 March 18
(0285y)

Table 4

HISTORICAL AVERAGE ELECTRIC CUSTOMERS

(1974 - 1984)

END-USE SECTOR	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	% Growth 1979-84	% Growth 1974-84
Residential	177,813	186,291	195,349	205,059	214,970	223,866	231,254	238,433	243,575	250,303	258,428	2.91	3.81
Farm	66,416	67,133	67,771	68,254	68,675	69,309	70,087	70,988	71,437	71,922	72,315	0.85	0.85
Commercial	39,129	40,380	41,066	42,192	42,164	42,400	42,989	43,873	44,443	44,921	46,092	1.68	1.65
Industrial	553	592	594	614	639	650	671	728	752	778	856	5.66	4.47
Bulk & SPC	442	464	477	486	481	500	528	577	604	611	611	4.10	3.29
TOTAL	284,353	294,860	305,257	316,605	326,929	336,725	345,529	354,599	360,811	368,535	378,302	2.36	2.90
% Change		3.70	3.53	3.72	3.26	3.00	2.61	2.62	1.75	2.14	2.65		

1985 March 18
(0285y)

Table 5

FORECAST ELECTRIC USE PER CUSTOMER

(1985 - 2005)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-1990	% Growth 1985-1995
Residential (kW.h)	7,673	7,783	7,892	8,001	8,110	8,211	8,291	8,371	8,452	8,533	8,615	1.36	1.16
Farm (kW.h)	19,426	19,830	20,242	20,663	21,094	21,534	21,769	22,036	22,306	22,581	22,858	2.08	1.64
Commercial (kW.h)	52,677	54,244	55,801	57,352	58,961	60,565	62,238	63,909	65,582	67,252	68,844	2.83	2.71
Industrial (MW.h)	3,522	3,582	3,676	3,989	4,091	4,071	4,095	4,135	4,199	4,276	4,328	2.94	2.08
Bulk & SPC (MW.h)	1,738	1,781	1,811	1,854	1,880	1,905	1,928	1,949	1,968	1,994	2,017	1.85	1.50

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
Residential (kW.h)	8,670	8,725	8,780	8,836	8,893	8,950	9,007	9,065	9,125	9,184	0.64	0.90
Farm (kW.h)	22,934	23,011	23,088	23,165	23,243	23,321	23,400	23,479	23,558	23,638	0.34	0.99
Commercial (kW.h)	70,164	71,489	72,821	74,157	75,499	76,847	78,201	79,561	80,952	82,292	1.80	2.26
Industrial (MW.h)	4,421	4,506	4,605	4,707	4,814	4,924	5,031	5,145	5,261	5,379	2.20	2.14
Bulk & SPC (MW.h)	2,041	2,063	2,087	2,108	2,125	2,144	2,175	2,202	2,231	2,257	1.13	1.32

1985 March 18
(0285y)

Table 6

HISTORICAL ELECTRIC USE PER CUSTOMER

(1974 - 1984)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	% Growth 1979-84	% Growth 1974-84
Residential (kW.h)	5,726	6,004	6,078	6,320	6,732	6,866	6,756	6,656	7,282	7,337	7,513	1.82	2.75
Farm (kW.h)	11,969	12,871	13,615	14,332	15,487	16,439	16,137	15,875	18,474	18,566	18,982	2.92	4.72
Commercial (kW.h)	34,115	35,788	37,011	37,858	39,769	43,179	46,293	47,102	47,708	49,943	51,076	3.42	4.12
Industrial (MW.h)	4,275	3,329	3,279	3,711	3,576	3,811	3,827	3,515	2,950	3,284	3,566	(1.32)	(1.79)
Bulk & SPC (MW.h)	1,507	1,536	1,581	1,626	1,728	1,747	1,740	1,648	1,680	1,700	1,819	0.81	1.90

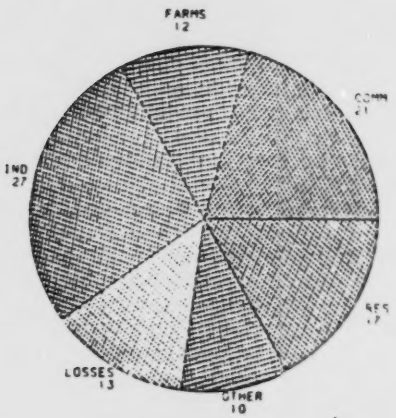
1985 March 18
(0285y)

B. Relative Growth Among Sectors and Impact Upon Consumption Mix

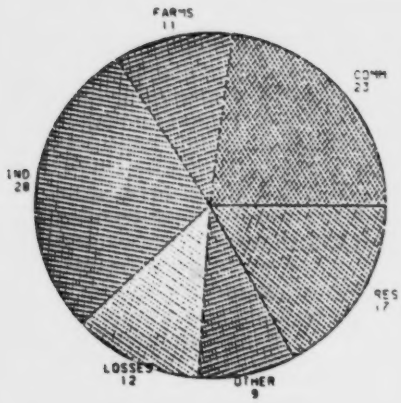
The proportions of total electric consumption and demand made up by the various sectors are shown in Figure 6. Sector shares change due to changes in the proportion of total growth during a period. A description of the relative amounts of growth which occurred in the last ten years and which is forecast to occur in the next ten and twenty year periods, follows.

Figure 6

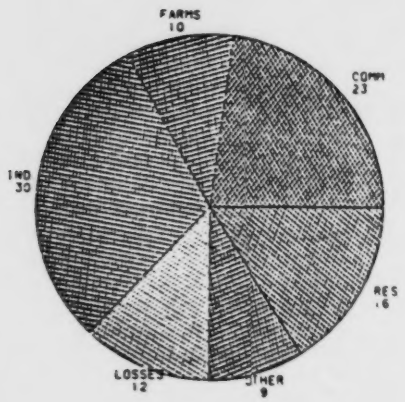
DISTRIBUTION OF ELECTRIC ENERGY REQUIREMENTS
1985, 1995, AND 2005



1985



1995



2005

As shown in Table 7, the most rapidly growing sectors were commercial (23.2% of total growth), residential (21.0% of total growth), and industrial (15.6% of total growth). The residential sector grew at an average annual rate of 6.7 percent; followed by commercials and farms at 5.8 and 5.6 percent, respectively. Industrial consumption grew at an average annual rate of 2.6 percent.

Table 7

DISTRIBUTION AND AVERAGE ANNUAL RATE OF ELECTRIC GROWTH BY SECTOR, 1974-84

Sector	Growth 1974-1984 Absolute (GW.h)	Growth 1974-1984 % of Total	Annual % Growth 1974-1984
Residential	923.5	21.0	6.7
Farm	577.8	13.1	5.6
Commercial	1,019.3	23.2	5.8
Industrial	688.7	15.6	2.6
Bulk & Other	445.6	10.1	5.3
Losses	748.8	17.0	7.6
TOTAL	4,403.7	100.0	5.1

Between 1985 and 1995, the increase in industrial consumption accounts for over 30 percent of the total increase in electrical requirements (See Table 8). This growth is expected from the potash industry, the steel mill, oilfields and the new heavy oil upgrader. High appliance and equipment saturation together with more efficient electrical appliances are expected to result in slower growth in other categories. For the period 1985-95 farm consumption is forecast to grow although at a slower rate than the other categories.

Table 8

DISTRIBUTION AND AVERAGE ANNUAL RATE OF ELECTRIC GROWTH BY SECTOR, 1985-95

Sector	Growth 1985-1995 Absolute (GW.h)	Growth 1985-1995 % of Total	Annual % Growth 1985-1995
Residential	579.5	16.1	2.6
Farm	308.2	8.6	2.0
Commercial	959.2	26.6	3.4
Industrial	1,122.5	31.2	3.1
Bulk & Other	277.0	7.7	2.3
Losses	354.6	9.8	2.2
TOTAL	3,601.0	100.0	2.7

Continued growth in potash consumption, development of heavy oil, increased consumption for oilfield pumping, and inclusion of unspecified speculative load results in the industrial sector leading with the largest share of growth (40%) during the period 1995 to 2005 (see Table 9). Residential and commercial growth is expected to slow down due to smaller increases in households, conservation, and appliance saturation. Farm growth will remain slow although increased use of electricity in farm production and substitution of electricity for oil used in space heating will continue to contribute to growth in this sector.

Table 9

DISTRIBUTION AND AVERAGE ANNUAL RATE OF ELECTRIC GROWTH BY SECTOR, 1995--2005

Sector	Growth 1995-2005 Absolute (GW.h)	Growth 1995-2005 % of Total	Annual % Growth 1995-2005
Residential	446.8	13.6	1.6
Farm	105.9	3.2	0.6
Commercial	745.0	22.7	2.0
Industrial	1,320.1	40.1	2.7
Bulk & Other	277.0	8.4	1.9
Losses	394.8	12.0	2.0
TOTAL	3,289.6	100.0	2.0

C. Sector Requirements

1. Residential

Residential consumption increased at an average annual rate of 6.7 percent per year from 1,018.1 GW.h in 1974 to 1,941.6 GW.h in 1984. Residential customers increased by 80,615 (an average of 8,062 customers per year) or 3.8 percent per year during the same period. In the last five years, the number of customers grew at an average rate of 2.9 percent per year (an average of 6,912 customers per year). The average consumption per customer also contributed to the growth in consumption, increasing from 5,726 kW.h in 1974 to 7,513 kW.h in 1984. This amounts to an average annual growth rate of 2.8 percent.

Residential consumption is forecast for each of three components; resorts, electric space heating, and regular. For each of these categories the average number of customers and average consumption per customer are forecast to arrive at total consumption. Total residential consumption is determined by adding the forecast for each of the components.

The total consumption is forecast to increase from 2,018.1 GW.h in 1985 to 3,044.4 GW.h in 2005, an average annual growth rate of 2.1 percent. The intermediate growth rates are forecast to be 2.6 percent and 1.6 percent for the periods 1985 to 1995 and 1995 to 2005, respectively.

Customers, which are based on the outlook for households and population, are forecast to increase by an average of 3,850 per year between 1985 and 1995 (1.4% per year growth rate) and 3,000 per year between 1995 and 2005 (1.0% per year growth rate).

Average consumption per customer is forecast to increase from 7,673 in 1985 to 8,615 kW.h in 1995 and 9,184 kW.h in 2005, an average annual growth rate of 1.2 percent and 0.6 percent, respectively.

a. Electric Space Heating

This category includes the total consumption for all end uses for those customers (including apartments) with electric space heating.

The forecast for the number of residential customers with electric space heating is based on the plan to supply natural gas to all communities in the province. This expansion of the natural gas system has the effect of reducing the non-farm electric space heating market. Therefore, the forecast is for customer additions of 170 per year between 1985 and 2005. By comparison, an average of 672 customers per year were added between 1979 and 1984.

The average consumption per customer is forecast to remain slightly above 27,400 kW.h for the 20-year period.

Combining the customer and consumption per customer forecast results in the forecast of sales to residential electric space heating customers increasing at a rate of 2.2 percent per year from 175.4 GW.h in 1985 to 268.5 GW.h in 2005.

b. Resorts

Resort customers are forecast to increase from 19,900 in 1985 to 26,800 in 2005, an average increase of 345 customers per year. By comparison, 594 customers per year were added between 1974 and 1984. The lower customer growth in the forecast reflects the fact that some lakes in the southern part of the province have their shorelines completely saturated. Future growth will come from cottages being built on lots which do not have a shoreline.

Consumption per customer will also continue to increase. This will be due to increased appliance saturation and greater use of the cottages themselves. Electric water and space heating as well as pressure systems and septic tanks are some uses which are expected to increase consumption per resort customer. Total resort consumption is forecast to increase at an average annual rate of 5.6 percent from 43.8 GW.h in 1985 to 129.2 GW.h in 2005.

c. Regular

This category includes all residential customers except those with electric space heating and resorts.

The forecast for total residential customers (including resorts and electric heat) was obtained from a forecast of households and Saskatchewan population in the following manner.

The population forecast and a forecast of persons per household were combined to produce a forecast of total households each year. The residential customer forecast was then determined by taking the annual change in households and adding it to the previous year's customer total. It was decided to use this method since almost all new growth in households is expected to be within the Saskatchewan Power Corporation service area. This means each additional household should be a new customer.

Based on this methodology, average regular customers are forecast to increase from 236,700 in 1985 to 294,900 in 2005, an average of 2,910 customers per year. The growth rate between 1985 and 2005 is forecast to be 1.1 percent per year compared to 3.4 percent between 1979 and 1984. The slower growth rate reflects the outlook for modest increases in housing stock over this period.

Average consumption per regular customer is forecast to grow at 0.8 percent per year over the forecast period as compared to an average growth of 2.1 percent per year for the last ten years.

In 1983 a Residential and Farm Survey was conducted by SPC. Table 10 illustrates the appliance saturation rates compared to the 1976 SPC survey. Electric stoves, freezers, and electric dryers have the highest saturation levels among the major appliances. The manual defrost fridge is being replaced by the frost-free fridge and the wringer washer is being replaced by the automatic washer. The largest growth in appliances occurred in freezers, color televisions, and microwave ovens.

Table 10

HOME APPLIANCE SATURATION COMPARISONS

Appliance	1976	1983
Electric stove	89.6	96.5
Natural gas stove	8.4	7.0
Microwave oven	1.0	29.1
Manual defrost fridge	59.9	45.8
Auto frost-free fridge	46.2	72.8
Freezer	60.0	92.4
Dishwasher	20.5	41.8
Wringer washer	24.6	12.6
Automatic washer	51.4	76.3
Electric dryer	69.3	79.7
Gas dryer	6.5	2.7
Central air	5.4	9.8
Window air conditioner	8.5	11.4
Humidifier	n.a.	30.9
Color television	79.4	110.7
B & W television	47.3	47.2
Stereo	n.a.	1.2
Electric sauna	n.a.	1.2
Hot tub	n.a.	0.8
Water bed heater	n.a.	22.5
Block heater	96.2	117.3
Car warmer	39.6	28.1
Timer for car	n.a.	15.6
Power Saver Cord	n.a.	4.0
Electric water heater	19.0	24.9

Combining the customer and consumption per customer forecasts results in the forecast of total sales to regular residential customers increasing at a rate of 2.0 percent from 1,798.9 GW.h in 1985 to 2,646.7 GW.h in 2005. By comparison, sales to these customers increased on average by 5.7 percent per year between 1974 and 1984.

2. Farm

Farm consumption grew at an average annual rate of 5.6 percent per year from 794.9 GW.h in 1974 to 1,372.7 GW.h in 1984. Farm customers increased an average of 590 each year.

Increased average consumption per farm customer accounted for much of the growth in sales during the past ten years. During this period, consumption per customer grew from 11,969 kW.h in 1974 to 18,982 kW.h in 1984, an average growth rate of 4.7 percent per year. Consumption per census farm (farms as defined by Statistics Canada) grew at a slightly faster rate of 6.3 percent from 11,227 kW.h in 1974 to 20,673 kW.h in 1984. This faster rate is explained by the increasing size of farms during this period. Electric water heating represents the single largest farm energy use. Water heating requires about 5,000 kW.h per year, and recognizing a saturation of about 83 percent implies that this use accounts for about one-third of the farm residence requirements and one-quarter of the total farm requirements.

For forecasting purposes, farm sales are broken into two groups; those with and those without electric space heating. Similar to the residential forecast, average customers and consumption per customer are forecast separately to determine total consumption.

Total sales are forecast to increase by 1.3 percent per year from 1,408.4 GW.h in 1985 to 1,822.5 GW.h in 2005. Increased use per farm due to continued mechanization of the farming operation is the main reason for this growth. Farms are expected to continue increasing in size as the number of farms is forecast to continue to decrease from 66,400 today to about 61,360 in 2005.

By 2005, average consumption per census farm is forecast to reach 29,702 kW.h. A high level of saturation of appliances and equipment, with the exception of space heating which is expected to be only about 20 percent, will be required to reach this forecast.

a. Electric Space Heating

Included in this category is the electric energy requirements for all end-uses for those customers with electric space heating.

Average consumption per farm is determined by adding an electric space heating requirement to the forecast average use per regular farm as described in the section on regular farms. Using this formula, average consumption per customer is forecast to increase from 43,839 kW.h in 1985 to 48,641 kW.h in 2005.

Due to the impact of the Saskatchewan Natural Gas Distribution Program (this will extend natural gas service to 25,000 farm customers), the addition of electric heat customers will be much slower than was the case in recent years. The forecast is for customers to increase from 6,600 in 1985 to 12,100 in 2005, an average annual increase of 275 customers per year.

Total sales to farms with electric space heating are forecast to increase at a rate of 3.6 percent per year from 289.3 GW.h in 1985 to 588.6 GW.h in 2005.

b. Regular

Farms are as defined by Statistics Canada rather than average customer numbers. This is done so we can look at the total use on a farm rather than the average use per farm service. Note that some farms have a second smaller service.

This category consists of those farms using a fuel other than electricity as their main space heating fuel. Deducting the forecast of farms with electric space heating from the number of census farms forecast for 2005 suggests that there will be about 49,260 regular farms.

Electric energy used on the farm is broken into two parts; the residence and other farming uses. Farm residence requirements were forecast based on a projection of appliance saturation levels derived from information in the 1976, 1978, and 1983 Farm Surveys. They are forecast to grow from 12,350 kW.h in 1985 to 14,275 kW.h in 2005, an average annual rate of 0.7 percent.

Table 11 illustrates the appliance saturation rates from the 1983 Farm Survey compared to SPC's 1976 and 1978 Farm Surveys. The saturation rate for all appliances with the exception of the wringer washer, car warmers, and manual defrost fridges have increased. Block heaters, freezers, microwave ovens, color televisions, automatic washers, and dishwashers are among the most notable increases.

Table 11

FARM HOME APPLIANCE SATURATION COMPARISONS

Appliance	1976	1978	1983
Electric stove	93.4	99.2	98.8
Natural gas stove	-	-	2.3
Microwave oven	2.7	9.6	34.7
Manual defrost fridge	118.2	70.2	52.6
Auto Frost-free fridge		60.7	86.2
Freezer	129.6	141.2	152.8
Dishwasher	25.1	35.2	52.8
Wringer washer	44.8	35.7	27.8
Automatic washer	39.2	51.1	72.5
Electric dryer	72.5	81.1	89.0
Gas dryer	n.a.	n.a.	1.1
Central air	3.1	3.5	4.6
Window air conditioner	6.4	7.3	7.6
Humidifier	n.a.	n.a.	28.5
Color television	72.7	87.2	109.7
B & W television	46.0	41.7	46.8
Stereo	n.a.	n.a.	86.0
Electric sauna	n.a.	n.a.	0.5
Hot tub	n.a.	n.a.	1.4
Water bed heater	n.a.	n.a.	21.4
Block heater	117.7	274.0	329.7
Car warmer	29.7	29.2	18.7
Timer for car	n.a.	n.a.	17.2
Power Saver Cord	n.a.	n.a.	3.6
Electric water heating	79.3	82.9	83.2

The list of equipment currently being used on the farm was included in the 1983 Farm Survey to get an idea of current saturation levels.

Table 12 illustrates the 1983 Farm Survey equipment saturation rates compared to the 1978 Farm Survey results. All farm equipment saturations have increased with the exception of the pressure system, heat lamp, and air compressor. The largest growth is in yard lighting, followed by water heaters, submersible pumps, and electric augers.

Table 12

FARM EQUIPMENT SATURATION RATE COMPARISONS

Appliance	1978		1983	
Refrigeration Unit	5.1		20.3	
Freezer unit	n.a.		23.4	
Air compressor	82.6		81.2	
Automatic feeder	2.5		6.1	
Watering bowl heater	62.9		63.5	
Water heater	14.2		27.4	
Electric auger	28.5		37.9	
Electric grain dryer	4.5		4.6	
Grain aerator	n.a.		25.2	
Electric feed mill	5.1		5.6	
Heat lamp	97.0		89.8	
Mercury vapor yard light	65.1	) 109.3	88.8	) 134.4
Incandescent yard light	44.2		45.6	
Electric manure system	1.9		2.4	
Pressure system	96.6		55.6	
Electric seed cleaner	6.0		9.2	
Submersible pump	26.4		38.4	
Ventilation fan	31.0		36.5	
Electric welder	n.a.		71.1	
Battery charger	n.a.		97.5	
Automatic waterer	n.a.		44.1	
Electric irrigation pump	n.a.		2.9	
Air-to-air heat exchanger	n.a.		2.8	
Heat pump	n.a.		0.5	

Farming operations are forecast to require about 11,531 kW.h per farm in 1995. Since there may be unknown future applications, this figure is forecast to reach 12,641 kW.h by 2005. This represents a growth of 0.7 percent per year.

Combining the residence and commercial use gives an average use per regular farm of 25,049 kW.h in 2005 which represents a 1.4 percent growth rate for the forecast period.

Total regular farm energy requirements are forecast to increase from 1,119.1 GW.h in 1985 to 1,233.9 GW.h in 2005. The low growth in requirements in the regular farm category is a result of decreasing customer numbers. Customers will decrease during the forecast period, for three reasons:

i. a shifting of farms from the regular to the electric heat category,

ii. a decline in the number of total farms, and

iii. small growth in use per customer.

3. Commercial

This category is made up of General Service II, III, IV Standard, V, and Street Lights.

a. General Service (excludes oilfields)

Sales increased in this category at a rate of 5.2 percent per year from 1,778.8 GW.h in 1979 to 2,294.6 GW.h in 1984. During this same period customers grew by an average of 738 per year reaching 45,199 in 1984.

General Service sales are forecast to increase at a rate of 2.7 percent from 2,450.1 GW.h in 1985 to 4,154.3 GW.h in 2005. A smaller growth rate in the future compared to the past is consistent with anticipated efforts by this group to become more efficient. The conversion to more efficient lighting and electric motors will be gradual as existing lighting and electric motors need replacing.

i. General Service II

This rate category consists of all commercial establishments with loads less than 15 kW. Some examples include small confectioneries and service stations.

Sales grew from 341.2 GW.h in 1979 to 394.6 GW.h in 1984 (3.0% per year) and are forecast to increase to 716.4 GW.h in 2005 (2.8% per year).

Customers in this category increased from 35,574 in 1979 to 37,223 in 1984 (average increase of 330 per year) and are forecast to increase to 39,800 in 2005 (an average of 115 per year).

The average consumption per customer grew at 2.0 percent per year from 9,591 kW.h in 1979 to 10,601 kW.h in 1984 and is forecast to reach 18,000 kW.h in 2005. This forecast represents an average growth rate of 2.5 percent per year.

ii. General Service III

This rate category consists of all commercial establishments with loads between 15 and 75 kW. The distribution of sales by standard industrial classification, which follows, gives an indication of the types of businesses in this category.

Table 13

GENERAL SERVICE III BY SIC

Divisions	Actual 1984 % of Total
Community, Business, & Personal Services (Div. 10)	37.91
Trade (Div. 8)	28.46
Transportation, Communications, & Other Utilities (Div. 7)	13.18
Finance, Insurance, & Real Estate (Div. 9)	9.01
Public Administration & Defense (Div. 11)	4.91
Other Six Divisions	6.53
TOTAL	100.00

Division 10 is primarily made up of elementary and secondary schools, hotels, and restaurants. Division 8 consists mainly of food and general merchandise stores, gasoline service stations, motor vehicle dealers; and wholesalers of farm machinery, lumber, and building materials. Division 7 is composed of transportation, grain elevators, radio and television broadcasting, and water and telephone systems.

Division 9, Finance and Real Estate, has grown steadily for the past five years; from 6.9 percent of total General Service III sales in 1978 to 9.2 percent in 1983. Approximately 65 percent (22.9 GW.h in 1983) of Division 9 is real estate operators. This includes all those buildings which are rented out to others but whose power bill is paid by the owner.

Sales grew at 7.0 percent per year from 375.9 GW.h in 1979 to 526.0 GW.h in 1984 and are forecast to grow by 2.7 percent per year reaching 920.0 GW.h by 2005.

Customers increased from 4,972 in 1979 to 6,736 in 1984, an average annual rate of 353 per year. They are forecast to reach 8,000 in 2005 (an average annual increase of 58 customers).

The average consumption per customer is forecast to grow at a rate of 1.9 percent per year from 78,088 kW.h in 1984 to 115,000 kW.h in 2005.

iii. General Service IV Standard

All commercial establishments with loads between 75 and 1,000 kW are included in this category. The types of businesses as shown by the sales distribution by Standard Industrial Classification are summarized as follows:

Table 14

GENERAL SERVICE IV STANDARD BY SIC

Divisions	Actual 1984 % of Total
Community, Business, & Personal Services (Div. 10)	27.21
Trade (Div. 8)	19.75
Manufacturing (Div. 5)	11.37
Transportation, Communications, & Other Utilities (Div. 7)	12.98
Finance, Insurance, & Real Estate (Div. 9)	11.89
Public Administration & Defense (Div. 11)	8.87
Mines, Quarries, & Oil Wells (Div. 4)	6.16
Other Four Divisions	1.77
TOTAL	100.00

Schools and hospitals represent 33 percent and 25 percent, respectively, of Division 10. More than 9 percent of General Service IV energy requirements goes to education and related services. Division 8 consists largely of food and general merchandise firms. Manufacturing (Division 5) has the food and beverage industry as by far its largest component. Metal fabricating and nonmetallic mineral products (clay and concrete products) are two other relatively large manufacturing sectors. Division 7 is largely transportation, storage (e.g., grain elevators), communication, and water systems. Division 9, as in General Service III, is made up largely of the real estate industry.

Sales grew at a rate of 4.3 percent per year from 703.9 GW.h in 1979 to 868.2 GW.h in 1984 and are forecast to grow at a rate of 2.6 percent per year reaching 1,539.7 GW.h in 2005.

The forecast is for an average annual growth rate of 0.9 percent reaching 902 MW.h per customer in 2005.

Customers increased from 911 in 1979 to 1,177 in 1984, which is an average annual rate of 5.3 percent. The forecast is for an average annual growth rate of 1.8 percent reaching 1,707 customers in 2005.

iv. General Service V

Commercial establishments with loads between 1,000 and 7,500 kW are included in this group. The sales distribution by Standard Industrial Classification is as shown in Table 15.

Table 15

GENERAL SERVICE V BY SIC

Divisions	Actual 1984 % of Total
Manufacturing (Div. 5)	18.61
Mines & Oil Wells (Div. 4)	22.87
Transportation, Communications, & Other Utilities (Div. 7)	29.68
Community, Business, & Personal Services (Div. 10)	11.24
Public Administration & Defense (Div. 11)	3.41
Finance, Insurance, & Real Estate (Div. 9)	8.49
Trade (Div. 8)	5.70
TOTAL	100.00

Manufacturing is made up, predominantly, of sawmills, cement manufacturers, and the food and beverage industry. Division 4, Mines and Oil Wells, has increased from 17.2 percent of total General Service V sales in 1983 to 22.9 percent in 1984. The increase is entirely due to the Crude Petroleum and Natural Gas Industry (SIC classification) which increased from 37 GW.h in 1983 to 79 GW.h in 1984. Other large consumers in the General Service V category are sodium sulphate mines, large merchandise stores, and large federal and provincial buildings (Division 11).

Sales increased from 357.8 GW.h in 1979 to 505.8 GW.h in 1984, which is an average annual growth rate of 7.2 percent. Energy sales are forecast to grow at 2.8 percent per year increasing from 517.0 GW.h in 1985 to 889.7 GW.h in 2005.

Customers increased from 51 in 1979 to 63 in 1984. By 2005, we expect to add another 19 customers.

b. Street Lights

Currently 893 communities are being provided with power for street lighting.

Sales have increased from 39.2 GW.h to 59.6 GW.h between 1974 and 1984 (4.3% per year). They are forecast to increase at a rate of 1.9 percent from 61.0 GW.h in 1985 to 88.5 GW.h in 2005. Street Light sales were correlated with the number of residential customers forecast to ensure consistency with the forecast of residential customers.

4. Industrial

Currently, the major industrial loads are potash mining, oilfields pumping, iron and steel manufacturing, and oil pipeline pumping.

Sales increased at a rate of 2.6 percent per year between 1974 and 1984. Table 16 shows that sales to potash mines make up by far the largest component of Industrial Sales. Potash sales also contributed the greatest proportion of increased sales during the past 10-year period.

Table 16

HISTORICAL INDUSTRIAL ELECTRIC SALES GROWTH 1974-1984

	1974		1979		1984		Growth 1974-1984	
	GW.h	% of Total	GW.h	% of Total	GW.h	% of Total	GW.h	% of Total
Potash	838.2	35.5	1,029.2	41.6	1,163.3	38.1	325.1	47.2
Oilfield	385.0	16.3	372.1	15.0	403.1	13.2	18.1	2.6
Oil Pipline	527.5	22.3	459.8	18.6	552.5	18.1	25.0	3.6
Iron & Steel	314.8	13.3	281.1	11.3	438.3	14.4	123.5	17.9
Other	298.3	12.6	334.8	13.5	495.3	16.2	197.0	28.7
TOTAL	2,363.8	100.0	2,477.0	100.0	3,052.5	100.0	688.7	100.0

1985 March 20
(0285y)

Industrial sales are forecast to grow at an average annual rate of 2.9 percent during the period 1985 to 2005.

Table 17 shows that potash, iron and steel, and oilfields make up almost all of the growth in industrial sales forecast for the period 1985-95 and potash and anticipated new loads make up all of the industrial growth after 1995.

A more detailed discussion of the major components of Industrial Sales follows:

a. Potash Mining

Production of potash is forecast to grow at a rate of 1.7 percent per year from 7,700 million tonnes in 1985 to 9,300 million tonnes in 1995. Beyond 1995, production of potash is projected to grow at a rate of 2.7 percent per year reaching 11,900 million tonnes in 2005. Electrical sales to potash mines are projected to grow at a rate of 2.3 percent over the forecast period.

b. Anticipated New Load

Included in the Forecast are provisions for a heavy oil upgrader beginning in 1988. It is expected to maintain a load of 175 GW.h (25 MW) from 1988 to 2005. Undefined electrical load is provided for beginning in 1996. This recognizes future loads which may occur but for which there is presently no firm commitment. The amount of speculative electric load included grows from 90 GW.h (17 MW) in 1996 to 890 GW.h (170 MW) by 2005.

c. Oil Pipeline Pumping

Electric sales to IPL are forecast to peak in 1989 at 641.5 GW.h and then gradually decrease to 507.9 GW.h in 2005. The forecast assumes that the amount of oil pumped across the province on its way to eastern markets is expected to decrease from 57 to 51 million cubic metres per year over the forecast period. In the past, electricity required for pumping has varied according to the amount of oil throughputs. In keeping with the historical trend, the kW.h requirements per metre will decrease from 10.3 in 1985 to 10.0 in 2005.

Table 17

FORECAST INDUSTRIAL ELECTRIC SALES GROWTH 1985-2005

	1985		1995		2005		Growth 1985-95		Growth 1995-2005	
	GW.h	% of Total	GW.h	% of Total	GW.h	% of Total	GW.h	% of Total	GW.h	% of Total
Potash	1,169.0	36.7	1,408.7	32.7	1,837.5	32.7	239.7	21.4	428.8	32.5
Oilfields	425.9	13.4	684.1	15.9	782.9	13.9	258.2	23.0	98.8	7.5
Oil Pipeline	585.3	18.4	605.3	14.1	507.9	9.0	20.0	1.8	(97.4)	(7.4)
Iron & Steel	432.0	13.6	666.2	15.5	666.2	11.8	234.2	20.9	0.0	0.0
Other Existing	511.9	16.1	707.2	16.4	707.2	12.6	195.4	17.4	0.0	0.0
Anticipated New Load	60.0	1.8	235.1	5.4	1,125.0	20.0	175.0	15.5	889.9	67.4
TOTAL	3,184.1	100.0	4,306.1	100.0	5,626.7	100.0	1,122.5	100.0	1,320.1	100.0

1985 March 20
(0285y)

d. Iron and Steel

The electrical consumption forecast is based upon a forecast received from the industry for the period 1985-89. Consumption is forecast to continue to grow until 1995 after which it will remain constant.

e. Oilfields

The oilfields electric energy forecast has been based on a trend extrapolation of the historical kW.h/m3 requirements and a forecast of oil production for the province. The forecast reflects the greater effort to pump oil from depleting oilfields. This trend is expected to continue and may accelerate if the heavy oilfields are electrified as is assumed in the forecast.

The forecast is for an average annual growth of 3.1 percent from 425.9 GW.h in 1985 to 782.9 GW.h in 2005.

5. Bulk

Bulk Sales grew at an average rate of 4.7 percent during the period 1974 (631.1 GW.h) to 1984 (995.3 GW.h). Saskatoon, Swift Current, and North Sask Electric bulk customers are forecast to maintain their current share of total electrical requirements growing at a rate of 2.2 percent per year from 1,030.1 GW.h in 1985 to 1,587.3 GW.h in 2005.

6. Saskatchewan Power Corporation Use

This category consists of Internal, Intersystem, and Coal Mining.

Sales to this class grew at an average annual rate of 13.5 percent from 32.8 GW.h to 116.3 GW.h for the ten-year period ending in 1984. Consumption is forecast to decrease at an average annual rate of 0.2 percent from 68.2 GW.h in 1985 to 65.0 GW.h in 2005.

7. System Losses

Losses are forecast based on 12 percent of total electrical requirements. They are forecast to grow from 1,471.1 GW.h in 1985 to 1,825.7 GW.h by 1995 and 2,220.5 GW.h by 2005.

D. Assessment of Confidence in the Forecast

In recognition of the uncertainty of the many factors on which this forecast is based, the following table summarizes forecast ranges associated with various levels of confidence (see Appendix K for a more detailed description). For planning purposes, the 80 percent confidence interval is being used as the basis of the forecast range (see Table 19 and Figure 7).

Table 18

TOTAL ELECTRIC REQUIREMENTS:
CONFIDENCE INTERVALS 1990, 1995, 2005

(MW)

% Confidence Level	1990		1995		2005	
	High	Low	High	Low	High	Low
40	2,719	2,535	3,021	2,794	3,756	3,297
60	2,787	2,474	3,092	2,719	3,901	3,201
80	2,874	2,405	3,184	2,634	4,073	3,048
95	3,006	2,324	3,336	2,481	4,301	2,803

Table 19

ELECTRICAL ENERGY AND PEAK LOAD FORECAST

Year	Net Electrical Requirement (GW.h)			Net Recorded Peak Load (MW)		
	High	Most Likely	Low	High	Most Likely	Low *
1984 (Actual)		11,272			2,095	
1985	12,099	11,630	11,179	2,376	2,200	2,035
1986	12,475	11,952	11,537	2,474	2,274	2,126
1987	12,976	12,398	11,867	2,568	2,359	2,193
1988	13,497	13,075	12,207	2,666	2,488	2,262
1989	14,039	13,484	12,556	2,768	2,565	2,333
1990	14,604	13,730	12,916	2,874	2,612	2,405
1991	14,946	13,995	13,157	2,933	2,663	2,449
1992	15,296	14,285	13,402	2,994	2,718	2,494
1993	15,654	14,596	13,652	3,056	2,777	2,540
1994	16,020	14,929	13,907	3,119	2,840	2,587
1995	16,395	15,231	14,166	3,184	2,898	2,634
1996	16,800	15,538	14,356	3,263	2,956	2,673
1997	17,215	15,843	14,549	3,344	3,014	2,712
1998	17,640	16,157	14,745	3,427	3,074	2,752
1999	18,076	16,475	14,943	3,512	3,135	2,792
2000	18,522	16,799	15,144	3,600	3,196	2,833
2001	18,979	17,130	15,348	3,690	3,259	2,875
2002	19,448	17,470	15,554	3,792	3,324	2,917
2003	19,928	17,818	15,763	3,876	3,390	2,960
2004	20,420	18,162	15,975	3,973	3,455	3,004
2005	20,925	18,521	16,190	4,073	3,524	3,048

*Derivation of low forecast of Net Recorded Peak Load currently under review.

Forecasting & Economic Analysis
1985 February 15
(0029y)

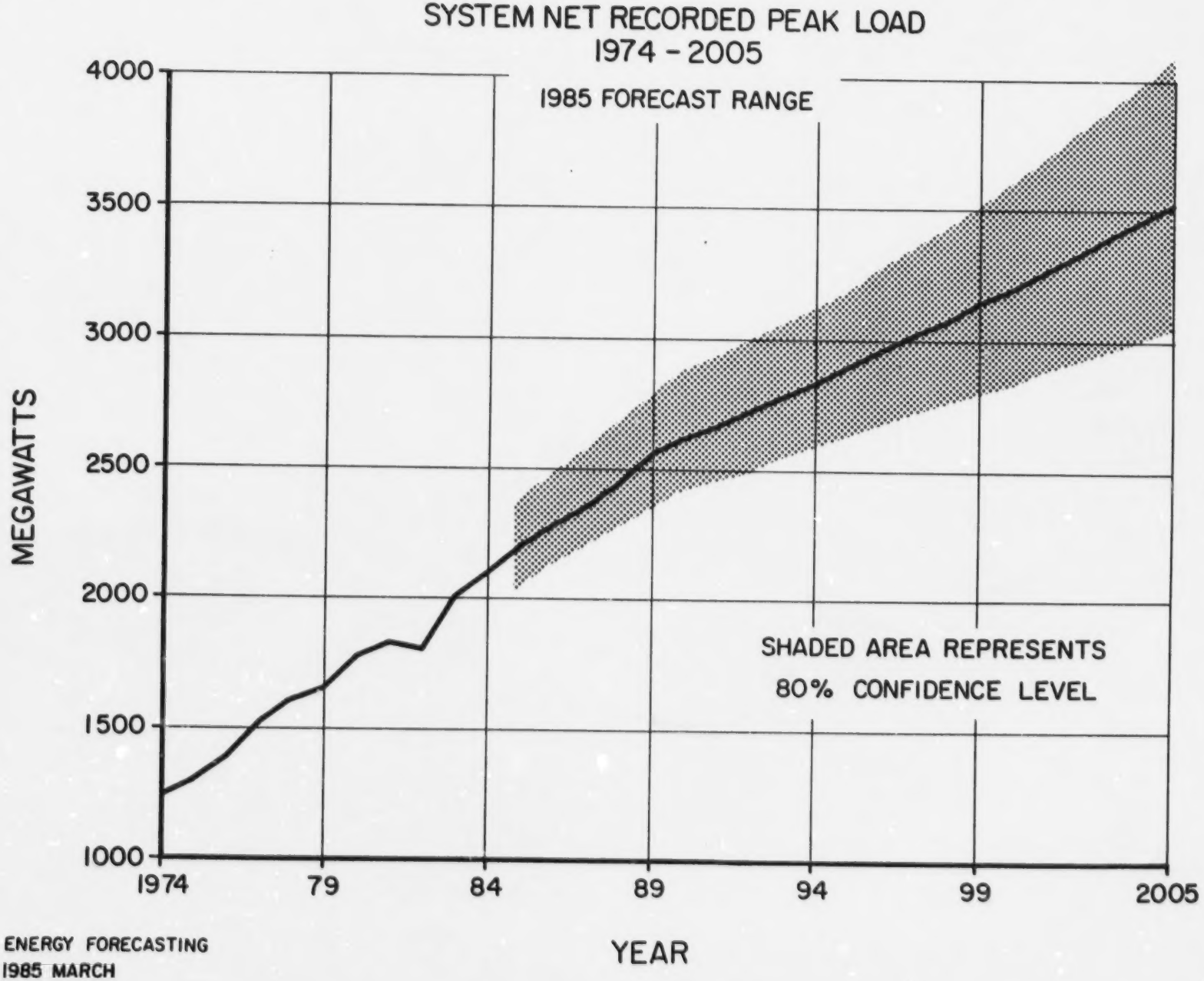

SYSTEM NET RECORDED PEAK LOAD
1974 - 2005
1985 FORECAST RANGE
4000
3500
3000
2500
2000
1500
1000
MEGAWATTS
SHADED AREA REPRESENTS
80% CONFIDENCE LEVEL
1974
79
84
89
94
99
2005
YEAR
ENERGY FORECASTING
1985 MARCH

Figure 7

IV. NATURAL GAS REQUIREMENTS FORECAST, 1985 TO 2005

A. Overview

Natural gas requirements (Table 20) are forecast to grow from 3,182.9 10^6 m^3 in 1985 to 3,775.3 10^6 m^3 by 1995 and 4,000.1 10^6 m^3 by 2005. Annual rates of growth are forecast to decline from 1.7 percent for 1985 to 1995 to 0.6 percent for 1995 to 2005. The comparable historical annual growth rate (1974-84) which has been normalized for weather, TCPL and power plants is 1.9 percent.[1] The relatively high rate of growth for the next ten years is due to the inclusion of a heavy oil upgrader (1988), and the Saskatchewan Natural Gas Distribution Program (completed by 1992). Beyond 1994, the lower growth rate is partially due to continuing conservation in the space heating load. It is estimated that the conservation efforts will reduce total requirements by 68.7 10^6 m^3 in 1995 from what they might have been without conservation. By 2005 conservation will have reduced annual potential demand by 110.2 10^6 m^3.

Tables 22 to 25 contain historic and forecasted data on the average number of natural gas customers and gas use per customer.

---

[1]The historical growth rate cited excludes TCPL and Power Plants which have both declined to the extent of offsetting growth in other categories.

Table 20

NATURAL GAS REQUIREMENTS FORECAST

(1985 - 2005)

(10^6 m^3 @ 101.325 kPa)

ENERGY REQUIREMENT

	1985*	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-1990	% Growth 1985-1995
END-USE SECTOR													
Residential	842.3	848.7	867.4	884.2	898.2	904.3	913.7	923.2	931.5	935.3	943.6	1.4	1.1
Farms	41.0	56.5	69.0	90.7	103.0	115.3	127.6	135.2	135.2	135.2	135.2	23.0	12.7
Small Commercial	190.4	191.7	194.7	197.3	199.0	198.8	199.4	200.0	200.2	199.5	199.7	0.9	0.5
Large Commercial	139.6	143.3	145.1	147.1	148.4	148.3	148.7	149.1	149.3	148.8	148.9	1.2	0.6
Small Industrial	337.4	345.9	350.0	352.6	355.7	355.4	356.5	357.5	358.0	356.7	357.1	1.0	0.6
Large Industrial	1,133.4	1,156.0	1,186.7	1,209.0	1,234.2	1,237.1	1,243.1	1,247.4	1,258.4	1,282.7	1,292.8	1.8	1.3
TOTAL RETAIL	2,684.1	2,742.0	2,813.0	2,880.8	2,938.3	2,959.3	2,989.0	3,012.5	3,032.7	3,058.2	3,077.1	2.0	1.4
% Change		2.2	2.6	2.4	2.0	0.7	1.0	0.8	0.7	0.8	0.6	0.5	
Power Plants & Other SPC	132.3	116.1	96.4	125.2	149.4	174.4	166.4	127.4	150.4	152.4	115.4	5.7	(1.4)
Compressors	44.4	46.8	47.6	52.0	53.2	53.9	54.2	54.0	54.6	55.1	54.8	4.0	2.1
Unaccounted For	81.3	78.6	79.9	87.3	89.4	90.6	91.1	90.7	91.8	92.5	92.1	2.2	1.3
Speculative Load	0.0	0.0	0.0	195.1	195.1	195.1	195.1	195.1	195.1	195.1	195.1	0.0	0.0
Total Sask. Requirement	2,941.9	2,983.5	3,036.8	3,340.4	3,425.5	3,473.3	3,495.9	3,479.7	3,524.7	3,553.3	3,534.5	3.4	1.9
Total Alberta Requirement	241.0	240.1	240.2	240.3	240.4	240.4	240.5	240.6	240.6	240.7	240.8	0.0	0.0
TOTAL SYSTEM REQUIREMENT	3,182.9	3,223.6	3,277.0	3,580.7	3,665.8	3,713.7	3,736.3	3,720.3	3,765.4	3,794.0	3,775.3	3.1	1.7
% Change		1.3	1.7	9.3	2.4	1.3	0.6	(0.4)	1.2	0.8	(0.5)	0.7	

ENERGY REQUIREMENT

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
END-USE SECTOR												
Residential	948.3	957.4	960.4	966.1	970.9	976.6	979.0	984.8	986.2	994.2	0.5	0.8
Farms	135.1	135.1	135.1	135.1	135.0	135.0	135.0	134.9	134.9	134.9	0.0	6.1
Small Commercial	199.6	200.7	200.1	200.1	199.9	199.9	198.9	198.8	199.7	202.0	0.1	0.3
Large Commercial	148.8	149.7	149.2	149.3	149.1	149.1	148.4	148.3	149.0	150.7	0.1	0.4
Small Industrial	356.9	359.0	357.8	358.0	357.6	357.6	355.9	355.8	357.4	361.6	0.1	0.3
Large Industrial	1,302.8	1,312.8	1,322.8	1,332.8	1,342.8	1,357.0	1,371.2	1,385.3	1,399.8	1,414.0	0.9	1.1
TOTAL RETAIL	3,091.6	3,114.7	3,125.5	3,141.4	3,155.4	3,175.3	3,188.3	3,208.0	3,227.1	3,257.6	0.6	1.0
% Change		0.7	0.3	0.5	0.4	0.6	0.4	0.6	0.6	0.9		
Power Plants & Other SPC	126.4	120.4	99.4	99.4	93.4	99.4	114.4	160.4	159.4	150.4	2.7	0.6
Compressors	55.2	55.4	55.3	55.5	55.6	56.0	56.5	57.5	57.7	58.1	0.6	1.4
Unaccounted For	92.7	93.2	92.9	93.3	93.5	94.2	94.9	96.6	97.0	97.6	0.6	0.9
Speculative Load	195.1	195.1	195.1	195.1	195.1	195.1	195.1	195.1	195.1	195.1	0.0	0.0
Total Sask. Requirement	3,561.0	3,578.8	3,568.2	3,584.8	3,593.1	3,620.0	3,649.2	3,717.6	3,736.4	3,758.7	0.6	1.2
Total Alberta Requirement	240.8	240.9	241.0	241.1	241.1	241.2	241.3	241.3	241.4	241.4	0.0	0.0
TOTAL SYSTEM REQUIREMENT	3,801.9	3,819.7	3,809.2	3,825.8	3,834.2	3,861.2	3,890.4	3,958.9	3,977.8	4,000.1	0.6	1.1
% Change		0.5	(0.3)	0.4	0.2	0.7	0.8	1.8	0.5	0.6		

*Actual data for January and Gas dispatched data for February of 1985.

1985 March 13

Table 21

HISTORICAL NATURAL GAS REQUIREMENTS, 1974-1984

(volumes in 10^6 m^3 at 101.325 kPa)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	% Growth 1979-84	% Growth 1974-84
END-USE SECTOR													
Residential	704.7	774.8	735.8	750.5	804.1	844.6	782.6	728.3	874.5	808.3	840.9	(0.09)	1.78
Farm	3.9	6.1	6.7	6.7	8.8	11.3	10.5	9.9	13.5	14.4	22.2	14.50	19.00
S. Commercial	205.2	184.9	154.3	155.4	169.1	178.7	159.3	152.6	200.3	179.1	189.3	1.16	(0.80)
L. Commercial	180.2	150.5	128.4	129.3	138.2	141.0	132.5	124.2	145.4	137.9	140.3	(0.10)	(2.47)
S. Industrial	146.4	240.5	279.6	276.9	308.2	327.7	313.9	301.9	341.6	312.2	334.3	0.40	8.61
L. Industrial	1,040.2	990.6	1,009.3	1,042.0	1,080.0	1,103.2	1,119.2	1,138.5	995.8	1,021.5	1,112.0	0.16	0.70
TOTAL RETAIL	2,280.6	2,347.4	2,314.1	2,360.8	2,508.4	2,606.5	2,518.0	2,455.4	2,571.1	2,473.3	2,639.0	0.25	1.47
% Change		2.9	1.4	2.0	6.3	3.9	(3.4)	(2.5)	4.7	(3.8)	6.7		
Power Plants	276.7	183.1	320.8	411.0	221.7	190.0	214.2	146.0	195.4	129.4	143.3	(5.49)	(6.37)
Head Office	1.1	1.2	1.0	0.8	0.9	0.9	0.8	0.7	0.7	0.7	0.7	(4.9)	(4.42)
Compressors	58.3	52.7	46.4	38.7	34.4	31.8	33.1	40.6	44.5	34.2	37.0	3.08	(4.45)
Vented Gas	1.1	0.6	0.6	1.0	1.1	1.4	1.0	1.0	1.7	1.5	1.4	0.0	-2.44
Unaccounted For	142.4	107.9	113.0	87.7	86.3	88.5	79.7	16.7	100.8	88.7	33.2	(17.81)	(13.55)
Total Sask. Requirements	2,760.2	2,692.9	2,795.9	2,900.0	2,852.8	2,919.1	2,846.8	2,660.4	2,914.2	2,727.8	2,854.6	(0.45)	0.34
Alberta Requirements	677.0	360.8	288.8	284.2	309.0	329.7	296.0	209.2	242.9	219.9	238.2	(6.29)	(9.92)
TOTAL REQUIREMENTS	3,437.2	3,053.7	3,084.7	3,184.2	3,161.8	3,248.8	3,142.8	2,869.6	3,157.1	2,947.7	3,092.7	(0.98)	(1.05)
% Change		(11.2)	1.0	3.2	(0.7)	2.8	(3.3)	(8.7)	10.1	(6.6)	4.9		
NORMALIZED REQUIREMENTS	3,398.4	3,031.3	3,181.5	3,281.0	3,121.8	3,177.8	3,227.0	3,085.6	3,054.7	2,982.4	3,171.7	(0.04)	(0.69)
ACTUAL DEGREE DAYS (°C)	6,033	5,966	5,477	5,485	6,038	6,165	5,526	4,988	6,294	5,732	5,550	(2.08)	(0.82)

Table 22

FORECAST AVERAGE NUMBER OF NATURAL GAS CUSTOMERS

(1985 - 2005)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-90	% Growth 1985-95
Residential	217,560	222,114	227,509	233,125	237,342	239,472	242,488	245,528	248,270	249,797	252,557	1.9	1.5
Farm	7,501	10,069	12,618	17,230	19,740	22,250	24,760	26,320	26,330	26,340	26,350	24.3	13.4
S. Commercial	22,027	22,484	23,026	23,638	24,065	24,281	24,586	24,894	25,171	25,326	25,606	2.0	1.5
L. Commercial	4,404	4,489	4,591	4,702	4,787	4,831	4,892	4,953	5,009	5,040	5,096	1.9	1.5
S. Industrial	2,935	2,987	3,049	3,113	3,170	3,199	3,240	3,281	3,318	3,338	3,376	1.7	1.4
L Industrial	134	134	134	134	134	134	134	134	134	134	134	0.0	0.0
TOTAL	254,561	262,277	270,927	281,942	289,238	294,167	300,100	305,110	308,232	309,975	313,119	2.9	2.1
% Change		3.0	3.3	4.1	2.6	1.7	2.0	1.7	1.0	0.6	1.0		

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
Residential	255,030	259,093	260,943	265,776	266,253	269,112	270,661	273,541	274,781	277,988	1.0	1.2
Farm	26,360	26,370	26,380	26,390	26,400	26,410	26,420	26,430	26,430	26,430	0.0	6.5
S. Commercial	25,856	26,267	26,455	26,741	26,992	27,282	27,439	27,730	27,856	28,180	1.0	1.2
L. Commercial	5,146	5,228	5,265	5,323	5,373	5,431	5,462	5,520	5,546	5,610	1.0	1.2
S. Industrial	3,409	3,464	3,489	3,527	3,561	3,599	3,620	3,659	3,676	3,719	1.0	1.2
L Industrial	134	134	134	134	134	134	134	134	134	134	0.0	0.0
TOTAL	315,935	320,556	322,666	325,891	328,713	331,968	333,736	337,014	338,423	342,061	0.9	1.5
% Change	0.9	1.5	0.7	1.0	0.9	1.0	0.5	1.0	0.4	1.1		

1985 March 27
(0285y)

Table 2 3

HISTORICAL AVERAGE NATURAL GAS CUSTOMERS

(1974 - 1984)

END-USE SECTOR	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	% Growth 1979-84	% Growth 1974-84
Residential	146,487	154,607	163,330	172,268	178,861	185,037	191,061	195,543	200,448	207,498	214,176	3.0	3.9
Farm	486	721	838	851	689	625	602	601	1,171	1,623	3,887	44.1	21.1
S. Commercial	16,454	16,332	16,467	17,226	17,652	18,336	18,696	19,639	20,552	21,167	22,039	3.7	3.0
L. Commercial	3,287	3,402	3,615	3,779	3,915	3,928	4,220	4,118	3,923	4,106	4,145	1.1	2.3
S. Industrial	910	1,822	2,189	2,296	2,454	2,511	2,657	2,628	2,607	2,728	2,792	2.1	11.9
L. Industrial	135	136	141	139	140	138	139	141	139	134	133	(0.70)	(0.1)
TOTAL	167,759	177,020	186,580	196,559	203,711	210,575	217,375	222,670	228,840	237,256	247,172	3.3	4.0
% Change		5.5	5.4	5.3	5.6	3.4	3.2	2.4	2.8	3.7	4.2		

1985 March 21
(0285y)

Table 24

FORECAST NATURAL GAS USE PER CUSTOMER

(1985 - 2005)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	% Growth 1985-95
Residential (m^3)	3,872	3,821	3,813	3,793	3,784	3,776	3,768	3,760	3,752	3,744	3,736	(0.4)
Farm	5,461	5,609	5,470	5,262	5,217	5,182	5,154	5,138	5,235	5,133	5,130	(0.6)
S. Comm. (m^3)	8,646	8,525	8,457	8,345	8,268	8,189	8,110	8,033	7,954	7,876	7,798	(0.1)
L. Comm. (m^3)	31,696	31,917	31,613	31,280	30,991	30,690	30,395	30,106	29,808	29,516	29,220	(0.8)
S. Indus. (10^3 m^3)	115	116	115	113	112	111	110	109	108	107	106	(0.8)
L. Indus. (10^3 m^3)	8,458	8,627	8,856	9,022	8,211	9,232	9,277	9,809	9,391	9,573	9,647	1.3

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth 1995-2005	% Growth 1985-2005
Residential (m^3)	3,719	3,695	3,681	3,663	3,646	3,629	3,619	3,600	3,589	3,576	(0.4)	(0.4)
Farm (m^3)	5,137	5,124	5,121	5,118	5,115	5,112	5,109	5,106	5,106	5,106	0.0	(0.3)
S. Comm. (m^3)	7,719	7,641	7,562	7,484	7,406	7,317	7,250	7,171	7,170	7,170	(0.8)	(0.9)
L. Comm. (m^3)	28,925	28,634	28,341	28,042	27,751	27,455	27,165	26,870	26,865	26,868	(0.8)	(0.8)
S. Indus. (10^3 m^3)	105	104	103	101	100	99	98	97	97	97	(0.9)	(0.8)
L. Indus. (10^3 m^3)	9,722	9,797	9,872	9,946	10,021	10,127	10,233	10,338	10,446	10,553	0.9	1.1

1985 March 28
(0285y)

Table 25

HISTORICAL NATURAL GAS AVERAGE USE PER CUSTOMER

(1974 - 1984)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Annual % Growth 1979-84	Annual % Growth 1974-84
Residential (m^3)	4,810	5,011	4,505	4,357	4,496	4,564	4,096	3,725	4,363	3,895	3,926	(2.97)	(2.01)
Farm (m^3)	8,025	8,460	7,996	7,873	12,772	18,080	17,442	16,473	11,529	8,872	5,711	(20.58)	(3.34)
S. Commercial (m^3)	12,471	11,321	9,370	9,021	9,580	9,746	8,521	7,770	9,746	8,461	8,589	(2.50)	(3.66)
L. Commercial (m^3)	54,822	44,239	35,519	34,215	35,300	35,896	31,398	30,160	37,063	33,585	33,848	(1.17)	(4.71)
S. Industrial (10^3 m^3)	161	132	1128	121	126	131	118	115	131	114	120	(1.74)	(2.90)
L. Industrial (10^3 m^3)	7,705	7,284	7,158	7,496	7,714	7,994	8,052	8,074	7,164	7,623	8,361	0.90	0.82
Degree Days % Variance from Normal	(2.79)	(1.65)	6.68	6.54	(2.88)	(5.04)	5.84	15.01	(7.24)	2.33	5.44		

NOTE: () Indicates colder than normal.

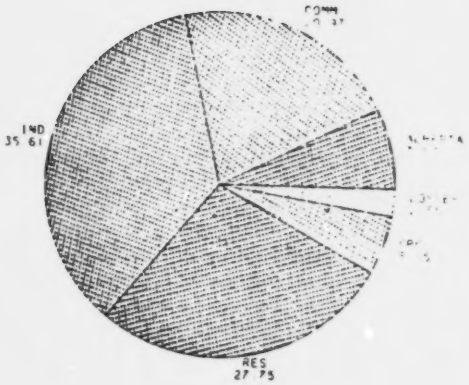
1985 May 08
(0285y)

B. Relative Growth Among Sectors and the Impact on Consumption Mix

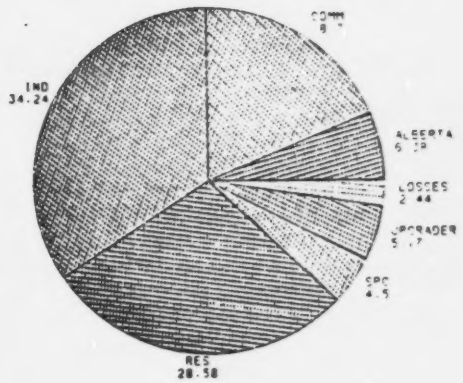
The proportions of total natural gas consumption made up by the various sectors are shown in Figure 8. Sector shares change due to changes in the proportion of total growth over the forecast period. A description of the relative amounts of growth which occurred in the seventies and early eighties, and which is forecast to occur during the next two decades, follows.

Figure 8

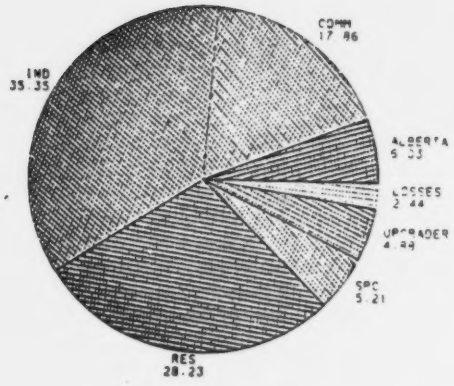
DISTRIBUTION OF NATURAL GAS ENERGY REQUIREMENTS
1985, 1995, AND 2005



1985



1995



2005

As shown in Table 26, between 1974 and 1984 growth occurred in each of the residential (2.0%/a), commercial (2.2%/a), and industrial (0.7%/a) categories. Offsetting this growth was a large decline in sales to TCPL (contract expired in 1980) and power plant volumes. In 1984, sales were zero and 143.3 10^6 m^3, respectively. By comparison in 1974, they were 667.5 10^6 m^3 and 267.7 10^6 m^3.

Table 26

DISTRIBUTION AND AVERAGE ANNUAL RATE
OF NATURAL GAS GROWTH BY SECTOR, 1974-1984

Sector	Growth 1974-1984 Absolute 10^6 m^3	Growth 1974-1984 % of Total	Annual % Growth 1974-1984
Residential & Farms	154.5	44.9	2.0
Commercial	132.1	38.4	2.2
Industrial	71.8	20.8	0.7
Power Plants & Other	(593.6)	(172.4)	(8.4)
Losses	(109.2)	(31.7)	(13.6)
TOTAL	(344.4)	100.0	(1.1)

Growth during the next ten years (see Table 27) is primarily due to adding a heavy oil upgrader in 1988 (195.1 10^6 m^3), potash growth (139.9 10^6 m^3), and the Saskatchewan Natural Gas Distribution Program (93.9 10^6 m^3).

Table 27

DISTRIBUTION AND AVERAGE ANNUAL RATE OF GROWTH BY SECTOR FROM 1985-1995

Sector	Growth 1985-1995 Absolute 10^6 m^3	Growth 1985-1995 % of Total	Annual % Growth 1985-1995
Residential & Farms	195.5	50.5	2.0
Commercial	38.3	9.9	0.6
Industrial*	159.4	41.2	1.3
Power Plants & Other	(16.9)	(4.4)	(1.4)
Losses	10.8	2.8	1.3
TOTAL	387.1	100.0	1.3

*Includes a heavy oil upgrader which requires 195.1 10^6 m^3 starting in 1988.

During the period 1995-2005 (see Table 28),, continued growth in the potash industry (121.6 10^6 m^3), and growth in the commercial sector account for virtually all the forecast growth. Conservation offsets customer growth in the residential/farm sector.

Table 28

DISTRIBUTION AND AVERAGE ANNUAL RATE OF NATURAL GAS GROWTH BY SECTOR, 1995-2005

Sector	Growth 1995-2005 Absolute 10^6 m^3	Growth 1995-2005 % of Total	Annual % Growth 1995-2005
Residential & Farms	50.3	22.8	0.5
Commercial	8.6	3.9	0.1
Industrial*	121.2	54.9	0.9
Power Plants & Other	35.0	15.9	2.7
Losses	5.5	2.5	0.6
TOTAL	220.6	100.0	0.7

*Includes a heavy oil upgrader

C. Sector Requirements

1. Residential

Natural gas is consumed by the residential sector mainly for the purpose of space and water heating. This category does not include apartments. Growth in total consumption by the residential category stems from an increase in the number of customers served. The average consumption per customer, however, is expected to continue to fall primarily because of higher levels of weather proofing for new housing and the retrofitting of older stock. As is summarized in the following table, total residential consumption is forecast to increase from 840.9 10^6 m^3 in 1985 to 943.6 10^6 m^3 in 1995, and to 994.2 10^6 m^3 by 2005.

During this 20-year period, 60,000 customers are forecast to be added.[2] Offsetting this, average annual consumption per household is forecast to decline by about 6.6 percent from today's weather normalized level. By comparison, 67,700 customers were added during the past ten years. Customer additions are related primarily to growth in presently served areas. However, some customers were added during the early 1970's by extending service to new communities. In addition, some households which continued to heat with other fuels even after natural gas became available, gradually converted over time. Total residential consumption increased from 704.7 10^6 m^3 in 1974 to 840.9 10^6 m^3 in 1984, a compound increase of 1.8 percent per year. Average annual consumption per customer (normalized for weather) remained relatively constant at about 4.72 10^3 m^3 up until the mid-1970's. Since that time it has declined and is expected to decline further throughout the forecast period although at a slower rate than the preceding decade.

The Saskatchewan Natural Gas Distribution Program is expected to add about 3,100 new residential gas customers by 1988. These new customers will add approximately 11.8 10^6 m^3 to the forecasted annual consumption, with their annual use per customer assumed to track that of the existing residential customers.

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[2]About 5% of these new customers result from the Saskatchewan Natural Gas Distribution Program.

Table 29

RESIDENTIAL CONSUMPTION OF NATURAL GAS, 1974-2005

	1974	1979	1984	1990	1995	2005
Consumption (10^6 m^3)	704.7	844.6	840.9	904.3	943.6	994.2
Average Customers ('000)	146.5	184.8	214.0	239.2	252.3	277.7
Use/Customer (10^3 m^3)	4.81	4.57	3.93	3.78	3.74	3.58

*1974-1984 based on actual data. The forecast reflects normal weather.

2. Farms

About 5,800 farms are presently served with natural gas. With the continuation of the Saskatchewan Natural Gas Distribution Program, approximately 19,050 new farm customers are expected to be connected to SPC facilities by 1992. Consumption by this category is expected to grow from 41.0 10^6 m^3 in 1985 to 115.3 10^6 m^3 in 1990 and to 135.2 10^6 m^3 in 1995. Beyond 1995, consumption is forecast to slowly fall to 134.9 10^6 m^3 in 2005 due to conservation.

3. Commercial

Natural gas consumed by this category is mainly for space and water heating. Included in this category are apartments and nonresidential retail customers whose annual demand does not exceed 660 10^3 m^3.

This category relates closely to the residential sector. The number of customers in this category is 13.5 percent of the residential forecast. Commercial volumes were approximately 79 percent of residential volumes in 1984. The historical percentage has fluctuated from 74 percent in the mid-1970's to 77 percent in 1978-80. The forecast maintains the historic relationship to the residential sector. Growth in this category stems from customer growth. The consumption per customer is expected to fall, like the residential, and is expected to decrease by approximately 15 percent over the forecast period.

As is summarized in Table 30, commercial consumption is forecast to increase from 663.9 10^6 m^3 in 1984 to 705.7 10^6 m^3 in 1995 and to 714.3 10^6 m^3 by 2005. During this 20-year period, 8,143 customers are forecast to be added, which includes approximately 400 customers from the gas extension program. This compares to 8,325 customers added over the past ten years.

Historically, average annual consumption per customer normalized for weather remained relatively constant at about 26.1 10^3 m^3 until the mid-1970's. Since then, it has begun to decline. Total consumption in this sector increased from 531.8 10^6 m^3 in 1974 to 663.9 10^6 m^3 in 1984, a compound increase of 2.2 percent per year.

The Saskatchewan Natural Gas Distribution Program is expected to add about 400 new customers by 1988. These new customers are expected to be generally smaller than the average commercial customer. As a result, the commercial use per customer was reduced by one-half for these new customers (as a group these new customers are forecast to consume approximately 5.6 10^6 m^3 annually).

Table 30

COMMERCIAL CONSUMPTION OF NATURAL GAS, 1974-2005*

	1974	1979	1984	1990	1995	2005
Consumption (10^6 m^3)	531.8	647.4	663.9	702.5	705.7	714.3
Average Customers ('000)	20.7	24.8	29.0	32.3	34.1	37.5
Use/Customer (10^3 m^3)	25.70	26.10	22.91	21.75	20.70	19.05

*1974-1984 based on actual data. The forecast reflects normal weather.

4. Industrial

The industrial sector currently makes up about one-third of the total natural gas requirements (see Figure 9). It is forecast to remain about one-third of total requirements over the forecast period. Included are 138 customers on average, with individual demands in excess of 660 10^3 m^3 annually.

The potash industry consumed about one-half of all gas consumed by this sector in 1984 (see Table 31). The amount of gas consumed by the potash industry was up by 11 percent over 1979. The increase since 1974 accounts for virtually the entire increase in industrial sales between 1974 and 1984.

The pulp and wood industry, which includes the Prince Albert Pulp Mill, a number of sawmills, and the plywood factory at Hudson Bay consumes about 8 percent of the total industrial consumption.

The Sodium Sulphate industry makes up about 5 percent of the total industry consumption. Natural gas is used primarily for drying their product. It is also used for heating and in the crystallization process.

A group of 37 customers is involved in manufacturing that is not wood related. This category accounted for a little more than 16 percent of total industrial sales in 1984. Major gas consumers include steel production, cement manufacturing, food and beverage, and petroleum refining.

The category "Education, Hospital, and Hotels" consists of 35 customers which consume about 6.6 percent of all industrial sales.

A group of 50 customers, referred to as "other" in Table 31 make up the remaining 9.1 percent of industrial sales. Major gas consumers include salt mines, public administration and defense, and summer loads involved in the feed industry. The decline in consumption since 1978 is partially due to recategorizing the Canadian Forces Base at Moose Jaw after installing individual meters rather than bulk metering. In addition, gas service was discontinued to the IPL oil pipeline pumping stations at Regina, Glenavon, and Kerrobert.

Consumption by the industrial sector is forecast to grow at a compound annual rate of 1.3 percent per year during the 1985-95 period and 0.9 percent per year during the 1995-2005

Table 31

HISTORICAL GROWTH IN INDUSTRIAL NATURAL GAS SALES, 1974-1984

Industry	1974			1979			1984			Growth 1974-84	
	Customers	Sales (10^6 m^3)	% of Total Sales	Customers	Sales (10^6 m^3)	% of Total Sales	Customers	Sales (10^6 m^3)	% of Total Sales	Sales (10^6 m^3)	% of Total Growth
Potash	8	484.8	46.6	10	551.9	50.0	10	613.1	55.1	128.3	178.7
Manufacturing	32	156.4	15.0	37	185.0	16.8	37	177.6	16.0	21.2	29.5
Wood	4	100.3	9.6	8	122.3	11.1	8	91.8	8.3	(8.5)	(11.8)
Education, Hospitals, & Hotels	35	81.7	7.9	36	78.6	7.1	35	73.9	6.6	(7.8)	(10.9)
Sodium Sulphate	7	100.4	9.7	7	68.9	6.2	7	55.0	4.9	(45.4)	(63.2)
Other	39	116.6	11.2	44	92.2	8.8	50	100.6	9.1	(16.0)	(22.3)
TOTAL	125	1,040.2	100.0	142	1,103.2	100.0	147	1,112.0	100.0	71.8	100.0

1985 March 26
(0285y)

period. Total consumption is forecast to increase from 1,133.4 10^6 m^3 in 1985 to 1,292.8 10^6 m^3 in 1995 and 1,414.0 10^6 m^3 by 2005. The potash industry is expected to maintain its dominant position accounting for virtually all industrial growth during the forecast period (see Table 32).

The only other industry to show any significant growth over the forecast period is steel production where gas consumption is forecast to increase from 42 10^6 m^3 in 1985 to 77 10^6 m^3 in 1995. After 1995, the steel production industry consumption level is left unchanged from the 1995 level.

5. Speculative Load

The heavy oil upgrader has been added in 1988. Annual volumes for this customer are forecast to be 195.1 10^6 m^3 (about 5% of total requirements).

6. Power Plant Usage

During the early 1970's, Power Plant Usage averaged about 400.1 10^6 m^3 annually. With the rising gas costs experienced in the mid seventies, Power Plant Usage dropped to between 129.0 10^6 m^3 and 321.0 10^6 m^3 per year except 1977. This reflects the increased use of coal, a cheaper fuel source in the generation of electricity.

Power Plant Volumes are forecast to gradually increase from 130.5 10^6 m^3 in 1985, peaking at 272.8 10^6 m^3 in 1990 and then falling back to the 92 to 165 10^6 m^3 range beyond 1990.

7. Other Saskatchewan Power Corporation Use

Other Saskatchewan Power Corporation Use includes compressor-station fuel gas, vented gas or gas blown into the atmosphere, and head office use.

With the increasing emphasis on conservation, head office use has decreased from normalized volumes of 1.1 10^6 m^3 in 1974 to 0.7 10^6 m^3 in 1984, a decrease of 36.0 percent.

Vented gas occurs when a gas line is cleared for maintenance or construction. The amount blown into the atmosphere is measured and the annual total is a function of construction and maintenance. Historically, SPC vents about 1.1 10^6 m^3 per year. This figure is used for the forecast volumes of vented gas.

Table 32

FORECAST GROWTH IN INDUSTRIAL NATURAL GAS SALES, 1985-2005

(10^6 m^3)

Industry	1985 Sales	1985 % of Total Sales	1995 Sales	1995 % of Total Sales	2005 Sales	2005 % of Total Sales	Growth 1985-95 Sales Growth	Growth 1985-95 % of Total Growth	Growth 1995-2005 Sales Growth	Growth 1995-2005 % of Total Growth
Potash	621.8	54.9	761.4	58.9	883.0	62.4	139.6	87.6	121.6	100.3
Manufacturing	193.9	17.1	218.2	16.9	221.4	15.7	24.3	15.3	3.2	2.6
Wood	92.8	8.2	92.5	7.2	92.3	6.5	(0.3)	(0.2)	(0.2)	(0.2)
Education, Hospitals, & Hotels	69.1	6.1	65.3	5.1	62.3	4.4	(3.8)	(2.4)	(3.0)	(2.5)
Sodium Sulphate	73.0	6.4	73.0	5.6	73.0	5.2	0.0	0.0	0.0	0.0
Other	82.8	7.3	82.3	6.3	82.1	5.8	(0.5)	(0.3)	(0.2)	(0.2)
TOTAL	1,133.4	100.0	1,292.8	100.0	1,414.0	100.0	159.3	100.0	121.4	100.0

Compressor-station fuel gas is a function of the amount of gas required to be transported through the system. As a result, the forecasted compressor-station volumes are a function of the total forecasted volumes for the system. Since the forecasted volumes are mainly increasing, the compressor-station fuel gas is increasing.

8. Unaccounted For

The unaccounted for gas is the difference between the gas supplied to the system and the gas sold or otherwise accounted for. Some reasons for system losses are: metering error, shrinkage or the reduction in volumes of wet natural gas due to the extraction of liquid products in a processing plant, and leakage.

Historically, the unaccounted for volumes have been 3 percent. However, in recent years that percentage has been falling below 3 percent possibly due to system improvements. As a result, this forecast assumes an unaccounted for percentage of 2.5 percent per year.

9. Alberta Contracts

Natural gas sales within the province of Alberta are of a contractual nature. The gas bought by these Alberta companies is used for sales to their customers or for use in field compressors.

Up until 1974, SPC had only one customer in Alberta, TransCanada Pipelines Limited. In 1974, an export permit was obtained from Alberta whereby SPC was allowed to extract gas from the Medicine Hat field. One condition of the permit was that SPC serve the City of Medicine Hat. Since that time, SPC has added five other customers.

TransCanada's contract terminated in 1980-November. Medicine Hat's (about 90% of the total Alberta requirements) contract runs to the end of 1993. However, the forecast assumes the contract with Medicine Hat will be extended beyond 1993. The forecast has not made allowances for further customers to be added in the future.

As shown in Table 33, the volumes used in Alberta during the 1970's were largely that of TransCanada and future volumes will be largely Medicine Hat.

Table 33

ALBERTA NATURAL GAS REQUIREMENTS

(volumes in 10^6 m^3)

	1974	1979	1984	1990	1995	2005
Requirements	677.0	329.7	238.2	240.4	240.8	2,414

D. Confidence Interval Forecast

In recognition of the uncertainty of the many factors on which this forecast is based, the following table summarizes forecast ranges associated with various levels of confidence. For planning purposes, the 80 percent confidence interval is being used as the basis of the forecast range (see Tables 34 & 35).

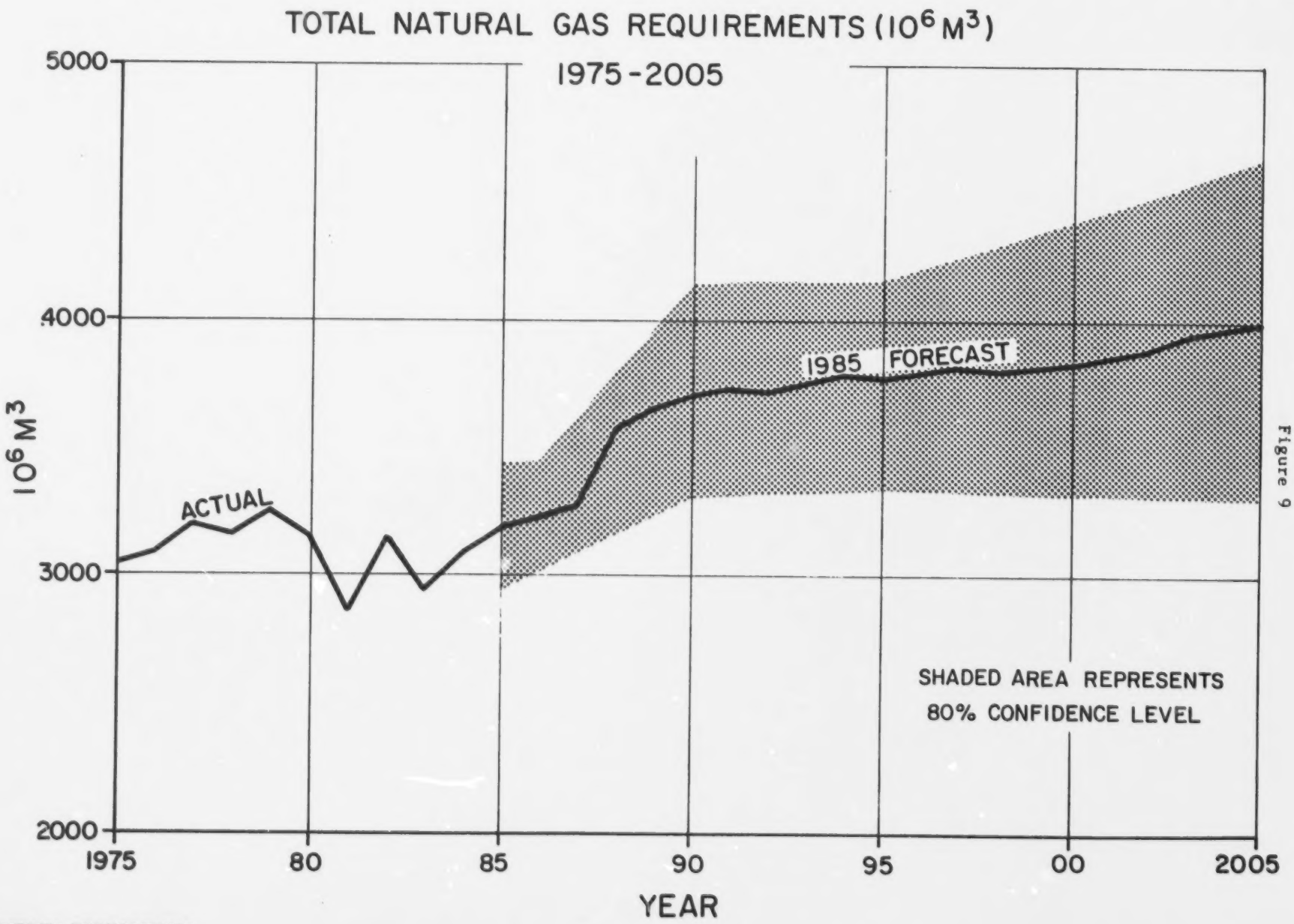
Table 34

TOTAL NATURAL GAS REQUIREMENTS:
CONFIDENCE INTERVALS 1990, 1995, 2005

% Confidence Level	1990		1995		2005	
	High	Low	High	Low	High	Low
40	3,929	3,560	3,914	3,585	4,252	3,689
60	4,008	3,472	4,006	3,487	4,442	3,546
80	4,151	3,313	4,166	3,343	4,645	3,315
95	4,329	3,060	4,355	3,132	5,092	2,956

This table shows that the narrower the forecast range the greater the chance that the actual load will fall outside that range.

Figure 9 combines the 80 percent confidence interval and this year's forecast i.e. most likely forecast.



ENERGY FORECASTING
1985 MARCH

Figure 9

Table 35

1985 NATURAL GAS LOAD FORECAST

(10^6 m^3)

Year	High	Most Likely	Low
1984 (Actual)		3,092.7	
1985	3,444	3,182.9	2,970
1986	3,453	3,223.6	3,010
1987	3,628	3,277.0	3,086
1988	3,802	3,580.7	3,162
1989	3,977	3,665.8	3,237
1990	4,151	3,713.7	3,313
1991	4,154	3,736.3	3,319
1992	4,157	3,720.3	3,325
1993	4,160	3,765.4	3,331
1994	4,163	3,794.0	3,337
1995	4,166	3,775.3	3,343
1996	4,214	3,801.9	3,340
1997	4,262	3,819.7	3,337
1998	4,310	3,809.2	3,335
1999	4,358	3,825.8	3,332
2000	4,406	3,834.2	3,329
2001	4,453	3,861.2	3,326
2002	4,501	3,890.4	3,323
2003	4,549	3,958.9	3,321
2004	4,597	3,977.8	3,318
2005	4,645	4,000.1	3,315

Forecasting & Economic Analysis
1985 March 14
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APPENDIX TO:

ELECTRICAL ENERGY

AND

NATURAL GAS REQUIREMENTS

1985 TO 2005

TABLE OF CONTENTS

		Page
A.	Real Gross Domestic Product	1
B.	Population	4
C.	Households	10
D.	Farms	17
E.	Oil Production	21
F.	Oil Pipeline Pumping	26
G.	Potash Mining	33
H.	Sodium Sulphate	46
I.	Manufacturing	48
J.	Commercial	50
K.	Load Forecasting with a Probabilistic Model	52

INTRODUCTION

The following papers on major sectors of the Saskatchewan economy are intended to provide a basic framework within which the forecast of electricity and natural gas requirements over the next twenty years has been prepared. The material was developed by the Economic Forecasting Department using information from a variety of sources including government departments, other crown corporations and private organizations.

Another function of these Background Papers, however, is to provide an indication of the uncertainty that exists in any forecast of energy requirements. Among the uncertainties in the forecast are the following:

i. Population is forecasted to grow fairly steadily but, apart from the last ten years, steady growth has not been Saskatchewan's experience. Indeed this province has seen more volatility in its population growth than any other province in Canada. Another factor, not considered in the forecast, is the possibility of a "breakthrough" in medical science that could reduce mortality substantially in a relatively short space of time.

ii. The forecast calls for a continuation of the decline in number of farms but at a rate far below that of the recent past. But, in the short run, the outlook is for lower grain prices while input costs continue to rise and this could accelerate the exodus from farming.

iii. Oil production continues to rise following the high levels of well completions over the last two years. While it is difficult to predict how long the current rate of drilling activity will last, the production forecast could certainly be on the low side if drilling does continue at record levels.

iv. Oil pipeline pumping depends upon the demand for refined petroleum products both in Canada and the United States and the level of oil production in Alberta and Saskatchewan. Pipeline flows have been buoyed by U.S. demand for Canadian crudes, particularly the heavy varieties and this is forecast to continue for a few more years. A falling off in demand or competition from low-cost offshore sources could affect volumes of oil and products moved through the IPL system.

v. Potash production recovered strongly in 1984 and has remained strong in the early months of 1985. New mines in New Brunswick and Jordan have experienced start-up problems but may reduce Saskatchewan producers' markets in the United States and offshore once those problems are resolved. Production could fall in 1985 unless sales improve in the next few months. On the other hand, production at U.S. mines, where ores are depleted, could fall sharply, leaving room to accommodate production from new mines.

vi. Steel production recovered well in 1984 despite stiff competition from offshore producers. The forecast assumes modest growth in the next few years on the basis of a healthy climate for oil and gas well drilling, higher levels of natural gas exports and continued access to U.S. markets. Should any of these assumptions prove to be erroneous, steel production could fall from forecasted levels.

In all sectors of the economy, growth or decline is unlikely to proceed as smoothly as forecasted. Hopefully, the general directions of the economy are predicted with reasonable accuracy and the magnitudes within the bounds of tolerance.

A. REAL GROSS DOMESTIC PRODUCT

Estimates of Saskatchewan's Real Domestic Product (RDP) (in constant 1971 $) for the period 1981-83 and forecasts, 1984 to 1989 are shown in Table A-1. The source is The Conference Board and estimates differ from those produced by the provincial government's Planning Bureau. Estimates and forecasts are published for seven goods-producing and five service-producing industries. Both are subject to frequent and fairly major revision.

The 1985-January forecast by The Conference Board continued to show modest growth in Total Real Domestic Product in 1984 (0.8%) despite a severe decline of 14 percent in agricultural output. By contrast, the Planning Bureau's estimates show a decline of 3.6 percent in real GDP for 1984 and Informetrica shows a decline of 1.8 percent. As a consequence of using different values in 1984, forecasts for 1985 may be expected to diverge also.

For the next five years (1984-89) total RDP is forecasted to increase by 14 percent or 2.64 percent annually, with goods-producing industries growing 18.5 percent (3.45% annually) and service-producing industries 11.3 percent (2.17% annually). After two years of exceptional growth, due mainly to strong recoveries in potash and oil, the mining sector remains flat for the next three years but manufacturing displays modest improvement and construction soars 26 percent (4.76% annually) as work proceeds on the heavy oil upgraders. Agriculture recovers from the 1984 drought but growth is modest and uneven after 1985.

As indicated above, the service-producing industries which roughly correspond to SPC's commercial sector, are forecasted to grow rather slowly over the next five years though strong growth is indicated for transportation, storage and communication.

Beyond 1989 there are aggregate RDP forecasts from the Planning Bureau and Informetrica.

	Planning Bureau	Informetrica
	(% change)	
1990	1.6	2.8
1991	0.8	1.8
1992	1.1	2.6
1993	1.2	2.6
1994	1.7	2.6
1995	n.a.	2.6
1996-2000 (annual)	n.a.	2.6
2001-2005 (annual)	n.a.	2.6

Informetrica's forecast looks for a relatively strong performance (2.9% annual growth) from the agricultural sector, with resource extraction at 2.7 percent and commercial and personal services a more modest 2.1 percent in the period 1990 to 2005.

Table A-1

REAL GROSS DOMESTIC PRODUCT, SASKATCHEWAN

(millions of 1971 dollars)

Industry	1981	1982	1983	Forecast 1984	1985	1986	1987	1988	1989	% Change 1981-89
Agriculture	629	769	711	615	705	697	720	743	767	21.9
Forestry, Fishing & Trapping	12	9	9	9	9	8	10	10	11	(8.0)
Mining	261	233	268	310	314	314	314	323	330	26.4
Manufacturing	261	233	239	253	261	265	271	281	289	10.7
Construction	346	306	346	340	346	362	390	406	429	24.0
Utilities	151	158	164	179	181	184	187	191	195	29.1
TOTAL GOODS-PRODUCING INDUSTRIES	1,661	1,707	1,738	1,706	1,815	1,831	1,892	1,954	2,021	21.7
Transportation, Storage & Communication	730	731	777	822	838	857	878	902	918	25.8
Wholesale & Retail Trade	604	581	602	579	572	584	614	649	685	13.4
Finance, Insurance & Real Estate	456	471	480	484	497	510	522	530	540	18.4
Community Business & Personal Service	707	710	736	785	786	798	817	829	846	19.7
Public Administration & Defence	305	312	301	293	298	301	305	308	310	1.6
TOTAL SERVICE PRODUCING INDUSTRIES	2,803	2,805	2,895	2,963	2,991	3,049	3,136	3,219	3,299	17.7
TOTAL ALL INDUSTRIES	4,464	4,512	4,633	4,669	4,806	4,880	5,028	5,172	5,320	19.2

SOURCE: The Conference Board, 1985 January

1985 April 17

B. POPULATION

1. Recent Developments

For the last few years, Saskatchewan has been able both to retain its natural population increase and to be a net beneficiary from migration. Detailed estimates for the twelve months ending October 01 in the last two years show sources of population growth as follows:

	Total Increase	Natural Increase	Rate/ 1,000	Net Migration	Rate/ 1,000
October-September					
1982-83	13,300	8,800	8.9	4,500	4.5
1983-84	14,100	9,200	9.0	5,000	5.0

Net migration was quite strong in both twelve month periods. By contrast, Alberta, which, in earlier years had attracted large numbers of migrants, experienced net migration losses of 16,600 in 1982-83 and 40,200 in 1983-84.

2. Rural-Urban Population Mix

According to census estimates, rural-farm population continues to fall but rural non-farm, which means all centres under 1,000 population, has increased over the last ten years. Percentage changes in the period 1961-81 were as follows:

Period	Total Pop.	Urban[1]	Rural Farm	Rural Non-farm[2]
1961-66	3.3	17.6	(8.2)	(6.8)
1966-71	(3.0)	4.8	(16.6)	(2.5)
1971-76	(0.5)	4.2	(17.5)	7.5
1976-81	5.1	10.0	(6.4)	3.4
1961-81	4.7	41.5	(40.8)	1.1

[1]Centres over 1,000 population.

[2]Centres under 1,000 population.

In this 20-year period, total population rose by 43,132 persons; urban population climbed by 165,000, rural farm population declined 125,000 and rural non-farm population increased marginally (2,500)

While financial and economic difficulties may result in further population losses in the farm sector in the shortrun, it is likely that this sector will remain at about its present level of 180,000 persons.

3. Sources of Population Change

Table B-1 shows changes in the components of population growth over the last ten years.

Table B-1

POPULATION IN SASKATCHEWAN

(percent)

June 01	TOTAL	Natural Increase	International Immigration	Interprovincial Migration[1]
1974	899,700	7,304	2,244	(14,348)
1975	907,400	7,593	2,837	(2,730)
1976	921,325	8,160	2,323	3,442
1977	934,900	8,953	2,231	2,391
1978	943,500	8,801	1,564	(1,765)
1979	951,300	9,575	2,762	(4,537)
1980	959,400	9,406	3,604	(4,910)
1981	968,300	9,686	2,402	(3,188)
1982	979,100	9,520	2,125	(645)
1983	992,700	8,890	1,731	2,979
1984	1,006,200	n.a.	n.a.	n.a.

[1]These numbers are derived from the other data. They will include some international emigration.

The above time series runs from the bottom of the recent population cycle to the present. The previous high population was 960,000 in 1968, from which it fell 6.3 percent (61,000 people) in the next six years before starting on the present upward trend.

Natural increase has been in the 8,000 to 9,000 range for the last 15 years and the most significant factor in population change has been net migration which, presumably is governed largely by perceptions about the provincial economy and employment opportunities both here and elsewhere.

4. The Significance of Migration

In 1921, 28 percent of Canada's population lived in the western provinces of Manitoba, Saskatchewan, Alberta and British Columbia. In 1981 that proportion remained the same but the distribution had changed significantly. These movements are shown in Table B-2.

Table B-2

POPULATION OF THE WEST AS A PROPORTION OF TOTAL CANADIAN POPULATION, 1921-81

Year	Manitoba	Sask.	Alberta	B. C.	The West
1921	6.9	8.6	6.7	6.0	28.2
1931	6.7	8.9	7.1	6.7	29.4
1941	6.3	7.8	6.9	7.1	28.2
1951	5.5	5.9	6.7	8.3	26.5
1961	5.1	5.1	7.3	8.9	26.4
1971	4.6	4.3	7.5	10.1	26.6
1981	4.2	4.0	9.2	11.3	28.7

SOURCE: Economic Council of Canada, Western Transition, 1984 (based on data from Statistics Canada).

Migration has been a highly important factor in Saskatchewan's population development. There were 921,785 people in this province in 1931 but, in the next 53 years, there was a net loss, through migration of about 600,000 persons and Saskatchewan's population did not pass the one million mark until the end of 1983.

Until very recently, Saskatchewan has consistently lost population to Alberta and British Columbia. There were net losses also to Manitoba and Ontario until about ten years ago but there have been net inflows from these provinces for about the last ten years. Modest population gains have been realized from Alberta and British Columbia in the last two

years possibly owing to the return of former emigrants in search of employment. A general indication of net interprovincial migration in the period since 1961 is shown below:

Period	Net Interprovincial Migration, Sask.
1961-66	(42,094)
1966-71	(81,399)
1971-76	(40,752)
1976-81	(9,716)
1981-82	(323)
1982-83	2,660

Source: Statistics Canada 91-21-, Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada and the Provinces, June 01, 1982 and 1983.

5. Population Projections by Statistics Canada

Table B-3

POPULATION PROJECTIONS OF SASKATCHEWAN TO 2006

(thousands)

Year	Project.1	Project. 2	Project. 3	Project. 4	Project. 5
1983	992.8	992.8	992.8	992.8	992.8
1986	1,034.4	1,027.3	1,036.4	1,029.3	1,029.4
1991	1,095.3	1,065.2	1,110.5	1,079.9	1,097.9
1996	1,143.7	1,094.6	1,183.9	1,132.9	1,172.8
2001	1,182.2	1,120.2	1,252.3	1,286.5	1,246.6
2006	1,215.6	1,143.0	1,316.8	1,238.0	1,317.9
% Change 1983-2006	22.4	15.1	32.6	24.7	32.7
National Increase	12.9	12.9	20.6	20.6	27.1

SOURCE: Statistics Canada 63-224, Market Research Handbook, 1984.

The above projections were developed by Statistics Canada based on varying assumptions about fertility, migration and economic conditions. Interestingly, in all cases, Saskatchewan's population is projected to increase at a rate significantly above the national rate. By contrast, projections developed about ten years ago projected either slow growth or declines in population in the period to 1986. The danger in this sort of exercise is that the forecaster tends to be unduly influenced by recent events.

Some of the features of these projections are:

i. Projection 1

Population growth in Saskatchewan, 1983-2006, is the second fastest in Canada (after Newfoundland). Alberta, Manitoba and Quebec all experience weak growth.

ii. Projection 2

Growth is largely concentrated in the western most provinces, Alberta (up 34.9%) and British Columbia (up 36.3%) while Canada east of Ontario scarcely grows at all.

iii. Projection 3

Saskatchewan leads the nation in population growth (except for Yukon) but most provinces, except Quebec, enjoy fairly strong growth.

iv. Projection 4

The Western provinces really dominate in this projection with British Columbia rising 46 percent, Alberta 45.8 percent and Saskatchewan 24.7 percent.

v. Projection 5

Strong growth occurs in every province west of Quebec and even the eastern provinces fare quite well as Canada's population sours to 31.5 million in 2006.

With the exception of Projection 2, which is close to SPC's recommended forecast, these projections appear high and would require fairly significant gains through migration from other provinces.

6. Population Forecast

In the period 1974-84, Saskatchewan's population grew at an annual rate of about 1.12 percent. On the assumption that economic growth over the next ten years will be moderate to slow but probably better than that of neighbouring provinces, the Planning Bureau forecasts relatively strong population growth averaging 1.1 percent, for the remainder of the 1980's but then slowing to about half that rate by 1993 with average growth over the entire 1984-94 period in the order of 0.82 percent. This assumes a net inflow of people attracted by employment prospects created by the construction of heavy oil upgraders at Regina and Lloydminster in the next few years followed by a resumption of historical patterns in which the province barely retains its natural increase and experiences small net losses from migration in some years. The postponement or cancellation of the upgrader projects would affect the forecast negatively or at least shift some of the growth into the 1990's.

For the period 1995 to 2005, population is forecasted to slow to an annual growth of 0.5 percent, reaching 1,125,000 in the year 2000 and 1,150,000 in 2005. More than anything, this slowdown is in recognition of future uncertainty and historical lessons, which suggest that growth will be uneven with periods of stability and possibly declines in population growth.

The following forecast is recommended for use:

	Number	% Change
1984	1,006	1.34
1985	1,019	1.29
1986	1,031	1.18
1987	1,042	1.07
1988	1,055	1.25
1989	1,063	0.76
1990	1,070	0.66
1991	1,076	0.56
1992	1,082	0.56
1993	1,087	0.46
1994	1,092	0.46
1995	1,097	0.46
2000	1,125	
2005	1,150	
1974-2005		14.3

C. HOUSEHOLDS

1. Housing Stock

Estimates of the housing stock in Saskatchewan for the period 1975 to 1983 are shown in Table C-1. Those estimates are derived through a perpetual inventory method and comprise all non-collective dwellings likely to be occupied permanently on a year-round basis but exclude mobile homes. Census data indicated about 11,000 mobile homes in 1976 and 14,000 in 1981. Adding these numbers to the estimates in Table C-1 produces a total housing stock of about 360,000 in 1981 of which, perhaps 342,000 were occupied. This is about 7,000 units higher than the number shown in the 1981 census and most of the difference is accounted for by estimates of vacant housing.

Assuming that these estimates are reasonably accurate and adjusting for the addition of mobile homes produces a total housing stock of about 373,000 units at the end of 1983, 360,000 of which were occupied. Adding dwelling completions in 1984 and adjusting for demolitions indicates total housing stock of about 377,000 units at the end of 1984 with about 364,000 units occupied.

2. Housing Characteristics

a. Size of Household

A survey conducted by SPC indicated that the size of a household, in terms of number of persons, has an influence on electricity consumption. In general, the bigger the household, the greater the consumption of electricity. The distribution of households, by size, in 1981 and estimated 1984, was as follows:

	1981	1984
	(% of total)	
1 Person	22.4	23.1
2 Persons	30.0	31.0
3 Persons	15.7	16.3
4-5 Persons	26.0	25.9
6 or more	5.9	3.7

Table C-1

HOUSING STOCK ESTIMATES, SASKATCHEWAN

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total Housing Stock	295,236	304,781	314,617	323,429	332,790	338,926	346,117	351,284	358,823
- Singles	237,619	245,636	254,177	261,421	269,521	274,747	278,595	280,886	284,607
- Multiples	57,617	59,145	60,440	62,008	63,269	64,179	67,522	70,398	74,216
Total Occupied Housing	278,000	285,000	292,800	299,900	308,000	316,200	327,800	337,800	345,000
- Singles	222,457	228,694	235,382	241,674	249,160	255,743	264,194	271,626	276,408
- Multiples	55,543	56,306	57,418	58,226	58,840	60,457	63,606	66,174	69,392
Vacant Housing	17,236	19,781	21,817	23,529	24,790	22,726	18,317	13,484	13,023
- Singles	15,162	16,942	18,795	19,747	20,361	19,004	14,401	9,260	8,199
- Multiples	2,074	2,839	3,022	3,782	4,429	3,722	3,916	4,224	4,824

SOURCE: Statistics Canada 64-003 Housing Stock in Canada, The Provines and Territories and CANSIM.

1985 April 17

The 1984 estimates are subject to substantial error but nevertheless generally corroborate the findings of the census, and, specifically, that more than half the households in Saskatchewan are composed of two persons or less. The number of one person households moved from 31,309 in 1961 to 44,550 in 1971 and 74,520 in 1981 and, with the aging of the population, may be expected to increase further.

The average size of a Saskatchewan household has declined from 3.77 persons in 1961 to 2.86 in 1981 and an estimated 2.78 in 1984. While the trend to smaller households may continue for several years yet, there are economic factors, such as relatively high levels of unemployment and declining real incomes, that should slow the process and even reverse the family undoubling process for a few years. On the other hand, there are likely to be more elderly people living alone which will push the average down. The current forecast is based on a very slow decline in household size, to 2.71 persons in 1995, 2.67 in 2000 and 2.64 in 2005.

b. Structural Type

This factor is significant for SPC as apartments on average use up to 40 percent less energy per unit of living space than single homes. In recent years, apartments have accounted for a greater proportion of new housing to accommodate the rising number of non-family households, single-person and small family households. In the period from the 1981 Census (June) to the end of 1984; 43 percent of dwelling completions were apartment units (10,400 units out of a total of 24,000 dwelling completions).

SPC estimates that apartments and flats constituted about 14.6 percent of total households in 1984 and that this proportion will climb to 17 percent in 1995 and 17.9 percent in 2005.

c. Period of Construction

Data from the 1981 Census, based on the 20 percent sample, provided an indication of the age of Saskatchewan's housing stock.

Period of Construction	Number of Dwellings	% of Total
1920 or Before	30,980	9.3
1921 to 1945	51,345	15.4
1946 to 1960	74,865	22.5
1961 to 1970	69,410	20.9
1971 to 1975	40,940	12.3
1976 to 1979	52,560	15.8
1980 to 1981 - May	12,605	3.8
TOTAL	332,710	100.0

One quarter of occupied private dwellings were built more than 35 years ago and 47 percent are over 21 years old. While many of these homes may have been upgraded or retrofitted to raise standards of insulation, many remain energy inefficient. Indeed, probably only those homes built after about 1975 (19.5 percent of total plus 24,000 completed since 1981) are constructed to high standards of energy efficiency. Obviously, this proportion will increase over time and, on the assumption that 5,000 to 6,500 dwellings will be completed annually in the next ten years, there should be about 150,000 dwellings built to high standards by 1995. By that time, the impact on heating requirements particularly, could be significant.

3. Household Facilities and Equipment

The annual survey of household facilities, conducted by Statistics Canada, provides supplementary information to that gathered by SPC in its surveys. In 1984, the survey covered residents of mobile homes for the first time. Table C-2 shows items of interest to SPC in respect to Saskatchewan households.

It bears repeating that the results of the survey are subject to a fairly high degree of error but some of the information is both interesting and useful.

i. the number of one and two-person households continues to grow and, combined,accounted for 54 percent of total households in 1984;

ii. 15 percent of households still use fuel oil as their principal heating fuel but 4 percent now use electricity, a sharp increase in the last five years. Some of the households listing wood as the principal fuel (3% of total) may have electricity as back-up;

iii. 31 percent of households use electricity to heat water, a large increase from 1983;

iv. the use of air conditioning is growing strongly and 65,000 households or 18 percent of the total have it;

v. 29 percent of households have a microwave oven, the second highest proportion in Canada;

vi. 32 percent have gas barbecues, the highest proportion in Canada (national average 19.7%);

vii. the number of households with automatic dishwashers (136,000) has climbed substantially in recent years;

viii. 23 percent of households have two or more automobiles, 8 percent have two or more trucks, and an unknown number have combinations of automobiles and trucks; and

ix. 12 percent of households conducted improvements to their heating or electrical equipment in the course of the last two years.

Table C-2

HOUSEHOLD FACILITIES AND EQUIPMENT, SASKATCHEWAN

	Number at 1984 March (thousands)	Percent of Total Households
1. Number of Households	355	100
2. Persons per Household		
1	82	23
2	119	31
3	58	16
4	59	17
5	33	9
6 or More	9	3
3. Type of Dwelling		
Single Detached	267	76
Single Attached	19	5
Apartment or Flat	55	16
Mobile Home	14	4
4. Principal Heating Equipment		
Steam or Hot Water Furnace	46	13
Hot Air Furnace	280	79
Heating Stove	14	4
Electric Heating	11	3
5. Principal Heating Fuel		
Piped Gas (natural Gas)	268	75
Fuel Oil	53	1
Propane	7	2
Electricity	14	4
Wood	12	3
6. Fuel for Heating Water		
Natural Gas	232	65
Electricity	109	31
7. Air Conditioning		
Window Type	36	10
Central Unit	29	8
8. Fuel for Cooking		
Natural Gas	13	4
Electricity	336	95
9. Household With:		
- Microwave Ovens	104	29
- Gas Barbecue	112	32
- One Refrigerator	275	77
- Two or more Refrigerators	78	22
- Home Freezer	276	78
- Automatic Dishwashers	136	38
- Electric Washing Machine	292	82
- Electric Clothes Dryer	261	74
- One Television Set	190	54
- Two or more Television Sets	157	44
- Electric Lawn Mower	61	17
- Snow Blowers	51	14
- Improvements to Heating or Electrical Equipment in Last two years	44	12
- Automobiles		
- one	201	57
- two	64	18
- three or more	16	5
- Vans and Trucks		
- one	114	42
- two or more	29	8

SOURCE: Statistics Canada 64-202, Household Facilities and Equipment, 1984 March.

4. Forecast of Number of Dwellings

The forecast follows the population forecast in Section B and assumes a slow decline in the average size of a household in Saskatchewan. Estimated and forecasted households, 1975 to 2005 are as follows:

Year	Total Occupied Dwellings	Apartments & Flats (thousands)	Non-apartments
June 30			
1975	289.0	36.0	253.0
1976	195.0	37.0	258.0
1977	304.0	38.5	265.5
1978	312.0	40.0	272.0
1979	321.2	41.0	280.2
1980	329.0	42.5	286.5
1981	338.0	44.0	294.0
1982	345.0	46.5	298.5
1983	355.0	50.0	305.0
1984	362.5	53.0	309.5
1985	366.5	55.0	311.5
1986	371.0	57.0	314.0
1987	376.0	58.0	318.0
1988	381.0	60.0	321.0
1989	386.0	62.0	324.0
1990	389.0	63.5	325.5
1991	392.0	64.5	327.5
1992	396.0	66.0	330.0
1993	399.0	67.0	332.0
1994	402.0	68.0	334.0
1995	405.0	69.0	336.0
2000	421.0	73.0	348.0
2005	435.0	78.0	357.0

NOTE: The above numbers relate to mid-year and thus differ from those referenced in section C-1 which are year-end.

D. FARMS

1. Number of Farms

The number of farm units in Saskatchewan continues to decline but the rate has slowed significantly. Annual rates of changes between census years are shown below along with estimates for the last three years.

Year	Number of Census Farms	Annual % Change
1941	138,713	-
1946	125,612	(2.0)
1951	112,018	(2.3)
1956	103,391	(1.6)
1961	93,924	(1.9)
1966	85,686	(1.8)
1971	76,970	(2.1)
1976	70,958	(1.6)
1981	67,318	(1.0)
1982 est.	67,000	(0.5)
1983 est.	66,700	(0.5)
1984 est.	66,400	(0.4)

2. Resident Farms

The 1981 Census showed 55,060 resident farms in Saskatchewan or 82 percent of total farms. The number was almost unchanged from that of 1976. This infers that there were about 12,000 non-resident farms whose use of electricity, if any, would be entirely commercial.

3. Farm Income

Despite a decline of 20 percent in crop production, farm cash receipts reached $4,221 million in 1984, up 6.5 percent from the previous year. Receipts from canola sales were particularly strong but sales of livestock and livestock products were strong also. The effects of the drought too were offset to a certain extent by crop insurance payments (up 38%) and Western Grain Stabilization Payments. But while the level of realized net income rose in 1984, the negative inventory change of $495 million produced a total net farm income of only $375 million, the lowest since 1970.

An indication of the volatility in farm incomes in Saskatchewan is provided in the following time series:

Year	Realized Farm Net Income	Farm Net Income Earned in 1984
	(millions of dollars)	
1975	1,407	1,486
1980	948	639
1981	1,142	1,606
1982	987	1,147
1983	757	819
1984 est.	870	375

Operating expenses and depreciation charges have climbed sharply over the last ten years, from $927 million in 1974 to $3,391 million in 1984. Interest on indebtedness, an item which has received much publicity recently, rose from $88 million ten years ago to $460 million in 1984, an increase of 423 percent.

Assuming that crop production returns more or less to normal in 1985, Agriculture Canada forecasts farm cash realized net income at $864 million, almost unchanged from 1984. Operating expenses will remain high but should not increase as severely as in recent years owing to somewhat lower interest payments on indebtedness and reduced machinery purchases.

Over the longer term, the provincial government's Planning Bureau is not optimistic about the prospects for farm income and expects farm purchasing power to remain relatively weak over the next ten years. The Economic Council of Canada came to the same conclusion in its 1984 study, Western Transition. Given international market trends and rising input costs, it is unlikely that agriculture would be able to contribute as much to future growth in incomes per capita and population as it did in the past. Many farmers will attempt to remain viable through off-farm work and tax files from 1979 indicate that almost half the income of farmers in that year was derived from off-farm sources. Others, faced with high costs and low or negative returns, may elect to sell their farms if the opportunity arises.

At the end of 1982, total outstanding farm debt in Saskatchewan stood at $3,660 million compared to $950 million ten years earlier. It is thought that this debt is unevenly distributed among farmers and that the bulk of debt is held by about one-third of the farmers. These are the farms which will face serious financial problems in the coming years. For Canada as a whole, 1,449 farms went bankrupt over the last three years and the Farm Credit Corporation recently suggested that 55,000 farmers were experiencing serious financial difficulties with about 1,700 liable to go under unless market prices improve significantly in 1985.

4. Factors Affecting Farm Numbers

The principal factors affecting the structure of the agricultural industry are thought to be demographic, technological and economic.

a. Demographic

The 1981 Census showed a slight decline in the average age of the farmer in Saskatchewan and, notably, an increase in the number of farm operations under the age of 35 (17,700 or 26% of total compared to 23% in 1976). Nevertheless, there were 7,000 operators over the age of 65 (10.6% of total) and it is reasonable to assume that they will retire from farming in the course of the next few years. The declining average age is expected to continue at least until 1991.

b. Technological

Increased productivity and economies of scale in agriculture are generally associated with capital-using technology and increased farm size. Fewer farmers are providing more food than five and ten years ago with the aid of modern machinery and farming methods. There is no indication that this trend has peaked and farms continue to get larger. In the next few years, however, the rate of technological change is expected to slow.

c. Economic

This factor is probably the most critical at present and promises to remain so for at least several years to come. High returns on investment provide the incentive and the funds necessary to generate output-increasing farm investment and attract new entrants into the industry. In recent years, however, returns have been low or negative and farmers in financial difficulties are those who made large investments at high rates of interest. As a result, there will be little incentive to undertake farm investment in the next few years and a generally conservative approach will be prevalent. This may produce lower rates of entry and higher rates of exit from farming where the opportunity exists to sell out.

5. Forecast of Farm Numbers

A paper written for the Canadian Agricultural Outlook Conference in 1984-December predicted that, for Canada as a whole, there would be 20,000 fewer farms in 1991 than there were in 1981. The decline would be 4.9 percent in the period 1981-88 and 1.4 percent for 1986-91. Assuming that Saskatchewan followed the national trend, this would indicate a loss of about 4,200 farms in this province. On the understanding that, on average, Saskatchewan farmers are somewhat better placed financially than Canadian farmers generally, the following forecast looks for a slower rate of decline in farm numbers.

Year	Number of Census Farms
1985	66,070
1986	65,740
1987	65,410
1988	65,085
1989	64,760
1990	64,435
1991	64,115
1992	63,795
1993	63,475
1994	63,160
1995	62,845
2000	61,975
2005	61,360

Tough financial times will force farmers to pare costs wherever possible. While electricity costs are not a large part of operating costs, improvements in efficiency of use may be expected. Also, farmers may be expected to take advantage of the natural gas program and sign up for service though not all may convert to gas use immediately.

E. OIL PRODUCTION

1. Recent History

Once again, in 1984, oil production surpassed all expectations to reach 10.8 million cubic metres, an increase of 13.2 percent over 1983 and 46 percent higher than the recent low point of 1981. Production from the Kindersley area rose 25 percent from 1983 and was double the level produced in 1980. Lloydminster heavy, much in demand in the last two or three years, climbed 12 percent in 1984 following a 21 percent advance in the previous year. Even Area IV, Estevan-Weyburn experienced an increase of 10.4 percent in 1984 to a level nearly 50 percent above that of 1981. Forty-two percent of provincial oil production originated in the Lloydminster-Kindersley areas in 1984 compared to 28 percent five years ago. Details are shown in Table E-1.

2. Number of Producing Wells

Historical data on producing oil wells (operational) for the period 1979 to 1984 are shown in Table E-2

Table E-2

NUMBER OF PRODUCING OIL WELLS, BY AREA

Area and Type	1979	1980	1981	1982	1983	1984
Area I Heavy	2,309	2,285	2,212	2,454	2,733	3,015
Area II Heavy	353	388	486	579	640	697
Area II Light	917	1,128	1,206	1,398	1,856	2,656
Area III Medium	918	929	903	906	948	1,042
Area IV Medium	1,540	1,576	1,519	1,544	1,604	1,873
Area IV Light	2,038	2,048	1,564	2,115	2,330	2,615
TOTAL	8,075	8,354	7,890	8,996	10,111	11,898

Table E-1

CRUDE OIL PRODUCTION BY AREA AND TYPE

(thousands of cubic metres)

	1978	1979	1980	1981	1982	1983	1984	% Change 1983-84
Area I Heavy	1,640	1,878	1,989	2,039	2,053	2,479	2,780	12.1
Area II								
- Heavy	357	346	391	565	672	730	801	9.7
- Light	414	428	492	490	486	670	950	41.8
TOTAL AREA II	771	774	883	1,055	1,158	1,400	1,751	25.1
Area III Medium	2,430	2,192	1,973	1,310	1,422	1,621	1,811	11.7
Area IV								
- Medium	2,298	2,210	2,231	1,611	1,702	1,704	1,949	14.4
- Light	2,485	2,315	2,254	1,377	1,771	2,330	2,503	7.4
TOTAL AREA IV	4,783	4,525	4,485	2,988	3,473	4,034	4,452	10.4
TOTAL PROVINCE	9,624	9,369	9,330	7,392	8,104	9,535	10,795	13.2

1985 April 17

The number of producing wells has climbed significantly in all areas of Saskatchewan in the last three years and raised producibility above forecasts made only one year ago. A record number of oil wells (2,125) were completed in 1984 and the hectic pace has continued into the early months of 1985, with 512 in the period to March 09, an increase of 33 percent over the corresponding period last year.

In some weeks, oil well completions in Saskatchewan have exceeded those in Alberta. This strongly suggests that producibility could climb further in 1985. One forecast (Mr. Arne Nielson, Chairman of the Canadian Petroleum Association) predicts a total of 3,500 wells (oil, gas and dry) in Saskatchewan this year. Others (Ted Best, BP Canada) feel that there will be a flattening of the growth curve. With the royalty free holiday scheduled to terminate at the end of this year, it is difficult to predict what direction drilling will take in 1986. But the Husky Bi-Provincial Upgrader alone will require the feedstock from 2,000 new wells in the Lloydminster area. Assuming that the project proceeds, these wells should be drilled over the next four years or so.

3. Oil Reserves

There was a net addition to provincial oil reserves in 1983 for the first time in 15 years. While actual estimates vary according to source, the National Energy Board placed remaining established reserves in Saskatchewan at 100.4 million m^3 on 1982 December 31. Since that time there have been two highly successful drilling years so that there should have been further additions to reserves.

4. Oil Production Forecast

Last year's forecast was based on estimated oil producibility as shown in the Province's submission to the National Energy Board. The forecast proved to be much too low for 1984 owing to increasing producibility resulting from record drilling activity. Similarly, this year's forecast, based on known and expected producibility at the end of 1984, may prove to be conservative if the 1985 drilling program is as successful as last year's.

For some time now, demand for Lloydminster heavy oil has far exceeded producibility and this could last for a few more years or at least until the highway repaving program in the

United States comes to an end. Similarly, demand for light oil, both Estevan and Kindersley types, has generally been strong. As was seen in the early weeks of 1985, however, demand for other types of oil, is subject to fluctuation and competitive market pressures. The availability of cheap offshore oil and refined products, even in the northern tier states, cut into Saskatchewan oil markets and resulted in substantial (6,500 m^3/day) shut-in capacity. The forecast (Table E-3) attempts to recognize these factors but generally assumes that markets will exist for Saskatchewan oil. In fact, the heavy oil upgraders are expected to be coming on stream at about the time when demand for heavy oil in the United States starts to ease off.

A significant factor as far as energy use by the oil industry is concerned is the volumes of heavy oil production which is forecasted. Lloydminster heavy accounted for about 26 percent of production in 1984 but is forecasted to rise to 32 percent of the total by the early 1990's and 35 percent in the year 2005. On the basis of last year's submission to the National Energy Board, enhanced recovery (E.O.R.) is expected to grow rapidly in importance; from about 3.5 percent of producibility in 1985 to 40 percent in 1995 and over 60 percent by 2005.

The present forecast looks for a modest increase in production this year (3.7%) and for production to peak at just under 12 million cubic metres in 1987 or 1988. Production is expected to be relatively flat thereafter until about 1995 after which it declines slowly.

Table E-3

OIL PRODUCTION IN SASKATCHEWAN: FORECAST TO 2005

(thousands of cubic metres)

	Lloydminster Heavy		Kindersley Blend		Swift Current Medium		Weyburn-Estevan Blend		Total
	$10^3 m^3$	% of Total	$10^3 m^3$	% of Total	$10^3 m^3$	% of Total	$10^3 m^3$	% of Total	$10^3 m^3$
1985	2,985	26.7	2,118	18.9	1,555	13.9	4,532	40.5	11,190
1986	3,162	26.7	2,500	21.1	1,569	13.2	4,612	38.9	11,843
1987	3,317	27.7	2,584	21.6	1,494	12.5	4,569	38.2	11,963
1988	3,408	28.5	2,593	21.7	1,462	12.2	4,486	37.5	11,950
1989	3,557	29.9	2,519	21.2	1,421	12.0	4,392	36.9	11,889
1990	3,598	30.5	2,453	20.8	1,401	11.9	4,334	36.8	11,787
1991	3,662	32.3	2,390	20.4	1,375	11.7	4,278	36.5	11,705
1992	3,680	31.7	2,310	19.9	1,350	11.6	4,282	36.8	11,622
1993	3,685	31.8	2,250	19.4	1,325	11.4	4,340	37.4	11,600
1994	3,700	31.7	2,200	18.9	1,300	11.1	4,470	38.3	11,670
1995	3,650	31.7	2,150	18.7	1,250	10.9	4,450	38.7	11,500
2000	3,350	31.8	1,800	17.1	1,035	9.8	4,365	41.4	10,550
2005	3,300	34.7	1,500	15.8	875	9.2	3,825	40.3	9,500

F. Showell
1985 April 17

F. OIL PIPELINE PUMPING

The demand for electricity for oil pipeline pumping is mainly dependent on such variables as the demand for refined petroleum products and, in turn, the movement of Alberta oil through Saskatchewan and the production of oil in Saskatchewan excepting that from the Weyburn-Estevan area (which enters the IPL system at Cromer, Manitoba) and the portion of heavy oil moved through the pipeline.

1. Demand For Refined Petroleum Products

Preliminary estimates on Canadian consumption of refined petroleum products published in Oilweek (1985 March 18) but compiled from Statistics Canada reports, shows little change in 1984 compared to revised estimates for calendar 1983. Consumption, by region, for the last five years is shown in Table F-1.

Table F-1

PETROLEUM CONSUMPTION BY PROVINCE

(m^3/d)

Province or Region	1980	1981	1982	1983	1984	% Change 1980-84
Ontario	90,870	86,160	78,760	75,003	78,448	(13.7)
Quebec	77,940	71,360	62,250	56,364	53,692	(31.1)
Atlantic Provinces	39,070	32,880	30,950	26,261	26,626	(31.9)
Prairies & NWT	52,390	52,380	49,490	48,166	47,186	(7.1)
British Columbia	30,950	30,380	27,700	25,211	24,398	(21.2)
TOTAL	291,220	273,160	249,150	231,006	230,350	(20.9)

Estimates for 1984 are subject to fairly significant revision but seem to indicate that the decline in consumption of petroleum products that began in 1979 finally ended last year, at least for the country as a whole. Consumption continued to fall in Quebec and, more moderately, in the Prairies and British Columbia.

The National Energy Board (NEB), in its report entitled Canadian Energy: Supply and Demand, 1983-2005 suggests that primary demand for oil in Canada could grow at an annual rate of 0.5 percent between 1983 and 2005 or could decline at an annual rate of 0.7 percent over the same period. This is the kind of range in possibilities with which we are dealing and it becomes very significant by the year 2005. The NEB's reference case looks for continued but slower decline in oil demand to a level of about 200,000 m^3/day in 1990 in response to more efficient use of oil and the substitution of other fuels in residential, commercial and industrial markets. Oil use in the transportation sector and for non-energy use such as the manufacture of asphalt and petrochemicals generates a small increase in total demand in the 1990 to 2005 period and demand returns to its 1983 level by the year 2005. The NEB suggests that there is a greater risk that the reference case has understated, rather than overstated, oil demand.

2. Oil Supply

Until now, Canada has depended upon the Western Canada Sedimentary Basin, now on a mature stage of development. The National Energy Board suggests that, in the next 20 years, there will be much more emphasis on the development of frontier areas and oil sands. Sources of oil production are forecasted as follows:

	1983	1990	2005
	(10^3 m^3/day)		
Conventional Light & Pentanes Plus	174.2	117.5	49.9
Oil Sands Synthetic (includes upgrading heavy oil)	23.5	42.5	63.5
Frontier	-	1.9	44.0
Total Light	197.6	116.9	157.4
Blended Heavy Crude & Bitumen	43.9	39.1	59.2
TOTAL	241.5	201.0	216.6

SOURCE: NEB Canadian Energy Supply and Demand, 1983-2005

The role of enhanced recovery will depend upon the development and costs of technologies and the price of oil but, potentially could be larger than that projected by the NEB.

The revised forecasts of Interprovincial Pipelines Ltd. developed in the latter part of 1984, certainly present a different picture for the next ten years or so, being roughly as follows:

	1985	1990	1995
	(10^3 m^3/day)		
Heavy & Medium Crude	47.7	95.4	95.4
Light & Synthetic	175.0	151.0	158.0
TOTAL	222.7	246.4	253.4

SOURCE: Oilweek, 1984 December 17

This was the justification for the expansion programs now underway for IPL to significantly raise pipeline capacity between Edmonton and Superior, Wisconsin, by late-1986.

In a report published in 1984-August, the Electric Utility Planning Council of Alberta predicted that new sources of crude oil would be available from Norman Wells (4,000 m^3/day starting in 1985) and Mackenzie Delta - Beaufort Sea (16,000 m^3/day starting in 1991) as well as heavy oil developments with upgrading. Another indication of the development of supplies was the request from Esso Resources Ltd. to begin the fifth and sixth stages of its Cold Lake oilsands project four years ahead of schedule.

A good deal will depend upon the economics of oil production (and they should have improved with the 1985-March agreement), world oil prices (which should be steady to lower for the next few years) and technological advances, particularly in the area of enhanced oil recovery but it is assumed that western Canada and the NWT will be able to meet demands for oil over the next 20 years.

3. Pipeline Throughput

Table F-2 shows markets for Alberta oil in the period 1976 to 1984. Since 1977, on average about 65 percent of Alberta sales have gone to markets east of that province via the Interprovincial Pipelines System. Canadian markets have been rather flat over the last three years and much below the peak level of 46.7 million m^3 recorded in 1979. Markets in the United States, however, have recovered in the past two years.

Table F-2

MARKETS FOR ALBERTA OIL, 1976 TO 1984

(thousands of cubic metres)

	1976	1977	1978	1979	1980	1981	1982	1983	1984 Estimated
Saskatchewan	1,465	1,501	1,245	1,850	2,170	2,275	1,999	1,646	1,761
Manitoba	1,438	1,209	1,468	1,298	1,288	1,081	1,502	769	-
Ontario	20,950	20,854	22,213	28,109	27,890	27,357	25,127	24,966	25,536
Quebec	4,787	12,968	13,982	14,471	14,983	10,972	11,604	9,579	8,195
Atlantic Provinces	-	-	-	-	61	-	1,370	2,644	2,495
TOTAL CANADA EAST OF ALBERTA	28,640	36,532	38,908	46,728	46,492	41,685	39,602	39,604	37,987
United States									
- District I	1,220	333	609	617	320	80	-	1,108	2,265
- District II	12,973	9,502	6,667	6,660	3,546	2,827	4,376	6,266	8,563
TOTAL EAST OF ALBERTA	42,833	46,367	46,184	53,005	50,358	44,592	43,978	46,978	48,815
PERCENT OF TOTAL	60.1	65.3	65.3	65.1	65.2	63.4	64.6	65.8	64.9
Alberta	12,726	13,657	13,875	15,860	15,723	15,426	13,834	15,198	17,156
British Columbia	6,239	6,393	6,526	7,486	7,455	7,451	6,802	5,793	5,966
United States									
- District IV	4,145	3,337	3,371	3,607	3,531	1,728	2,367	2,519	2,177
- District V	5,307	1,270	804	1,475	1,155	1,121	1,108	936	1,075
TOTAL ALBERTA, WEST & SOUTH	28,417	24,657	24,576	28,428	26,864	25,726	24,111	24,446	26,374
TOTAL MARKET	71,250	71,024	70,760	81,433	77,222	70,318	68,089	71,424	75,189

SOURCES: 26-213, The Crude Petroleum and Natural Gas Industry, 26-006, Crude Petroleum and Natural Gas Production, and Oilweek for nominations in late 1984.

1985 April 17

In addition to the crude oil shipments, shown in Table F-2, the IPL system has carried increasing volumes of refined products to areas where refineries have closed down (such as Manitoba). This accounts, in part, for the sharp increase in Alberta use of Alberta oil.

Future markets are difficult to predict but Canadian markets may decline slowly for several years yet while the United states market remains buoyant at least until the end of the 1980's. The demand for heavy crudes and bitumen has been particularly strong as a result of the major highway rebuilding program. There is even a market for some refined products following refinery closures in northern tier states.

Table F-3 projects oil flows through the IPL system in Saskatchewan for the period 1984 to 2005 by means of the following calculations:

i. Alberta oil sold to Ontario, Quebec, Atlantic, Manitoba, Saskatchewan and U.S. Districts I and II; PLUS;

ii. Saskatchewan oil produced in Areas I and II; EQUALS;

iii. IPL oil at Kerrobert; PLUS

iv. Saskatchewan oil from Area III LESS that sold in Saskatchewan; MINUS

v. Alberta oil sold in Saskatchewan; EQUALS;

iv. IPL oil at Regina.

Volumes at Kerrobert and Regina are averaged to arrive at a provincial total.

Despite the anticipated declines in conventional oil production, it is assumed that demand will be met from a combination of Alberta, Saskatchewan and NWT oil. Total throughput may peak within the next two years but remain fairly constant at about 55 million m^3 until 1996 when a slow decline sets in and throughput falls to 51 million m^3 in 2005.

IPL experienced capacity problems in 1984 and embarked on a program to raise pipeline capacity in two stages. The first, scheduled for completion in late-1985 will add 12,000 m^3/day to capacity through the addition of one pumping station unit in

Alberta and six in Saskatchewan (Cactus lake, Herschel, Bethune, Odessa, Craik and Langbank). A second stage will add a further 24,600 m^3/day by the end of 1986. Part of the problem is that much of the increased demand has been for higher viscosity heavy crudes which displace light crude in the light crude line in a ratio of about 2.5 to 1 thus reducing substantially the capacity of the light crude line.

Presumably, the pipeline capacity problems will ease with the conclusion of the road resurfacing program and with the upgrading of heavy crudes at Lloydminster and Regina (assuming that both proceed). For the next two or three years it appears that there will be a ready market in the nothern tier states for heavy oil provided that dilutents are available. In the past, condensates have served this purpose but supplies are diminishing and alternatives are being investigated.

Table F-3

OIL FLOWS THROUGH INTERPROVINCIAL PIPELINES SYSTEM, FORECASTED TO 2005

(thousands of cubic metres)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Alberta Oil East of Alberta[1]	50,310	52,000	53,000	52,000	50,000	50,000	49,000	49,000	50,000	50,000	50,000
Sask. Oil Areas I & II	4,530	5,195	5,662	5,901	6,001	6,076	6,050	6,050	5,990	5,985	5,900
IPL OIL AT KERROBERT	54,840	57,195	58,662	57,901	56,001	56,076	55,050	55,050	55,990	55,985	55,900
Sask. Oil Area III	1,814	1,555	1,569	1,494	1,462	1,421	1,401	1,375	1,350	1,325	1,300
Saskatchewan Refinery Use	(2,000)	(2,100)	(2,100)	(2,300)	(2,500)	(2,500)	(2,600)	(2,600)	(2,700)	(2,700)	(2,800)
IPL OIL AT REGINA	54,654	56,650	58,131	57,095	54,963	54,996	53,851	53,825	54,640	54,610	54,400
IPL AVERAGE OF KERROBERT & REGINA	54,747	56,923	58,396	57,498	55,482	55,536	54,450	54,438	55,315	55,297	55,150

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Alberta Oil East of Alberta[1]	50,000	49,000	49,000	48,000	48,000	48,000	47,500	47,500	47,000	47,000	47,000
Sask. Oil Areas I & II	5,800	5,680	5,520	5,370	5,230	5,150	5,090	5,020	4,950	4,880	4,800
IPL OIL AT KERROBERT	55,800	54,680	54,520	53,370	53,230	53,150	52,590	52,520	51,950	51,880	51,800
Sask. Oil Area III	1,250	1,200	1,140	1,090	1,040	1,035	1,000	975	940	910	875
Saskatchewan Refinery Use	(2,800)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)	(2,900)
IPL OIL AT REGINA	54,250	52,980	52,760	51,560	51,370	51,285	50,690	50,595	49,990	49,890	48,775
IPL AVERAGE OF KERROBERT & REGINA	55,025	53,830	53,640	52,465	52,300	52,217	51,640	51,557	50,970	50,885	50,788

[1] In forecast years includes some oil from N.W.T.

1985 April 17

G. POTASH MINING

1. Saskatchewan Production and Sales

Potash production surged to a record level of 7.65 million tonnes k_2O in 1984, an increase of 29 percent over 1983. Sales increased, too, but only to 7.03 million tonnes, leaving a substantial addition to potash inventories which totalled nearly 1.5 million tonnes at the end of 1984. A time series of production, sales and average prices over the last end years is provided in Table G-1.

Table G-1

PRODUCTION AND SALES OF SASKATCHEWAN POTASH

Year	Production	Sales	Difference	Ave. Price
	(thousands of tonnes k_2O)			($/t)
1974	5,496	5,720	(234)	54.38
1975	5,433	4,677	756	74.51
1976	4,991	5,168	(177)	69.35
1977	6,090	5,699	391	69.85
1978	6,113	6,453	(340)	76.82
1979	6,707	7,146	(439)	102.62
1980	7,302	7,127	175	141.68
1981	7,189	6,357	832	156.54
1982	5,212	5,087	125	126.37
1983	5,928	6,599	(671)	103.94
1984 Prelim.	7,652	7,032	622	122.00

SOURCE: Saskatchewan Energy and Mines, Mineral Statistics Yearbook, 1983, for data from 1974 to 1983.

2. Principal Markets for Saskatchewan Potash

The principal markets for Saskatchewan potash in the period 1978 to 1984 are shown in Table G-2. Total sales at 7.1 million tonnes k_2O, were up 7.8 percent from 1983 and close to the peak level of 7.2 million tonnes, recorded in 1979. While sales to Canadian markets continued to grow, those to the United States languished at less then 4.1 million tonnes, well below the 4.9 million tonnes of 1979. To a certain

Table G-2

PRINCIPAL MARKETS FOR SASKATCHEWAN POTASH

(thousands of tonnes K_2O)

	1978	1979	1980	1981	1982	1983	1984 Prelim.[1]
1. DOMESTIC							
- Canada	370	379	378	332	273	385	436
- United States	4,498	4,931	4,563	4,182	3,202	4,146	4,088
2. OFFSHORE	1,595	1,836	2,171	1,823	1,576	2,026	2,544
a. Asia							
- China	39	160	247	421	141	446	420
- India	246	213	288	275	224	277	406
- Japan	370	423	400	221	346	357	383
- Korea	145	157	151	159	218	191	240
- Taiwan	39	65	93	81	57	34	68
- Malaysia	88	105	104	57	83	86	129
- Other	121	120	116	94	143	130	185
Subtotal	1,048	1,243	1,399	1,308	1,212	1,521	1,831
b. South & Central America							
- Brazil	275	367	492	238	129	215	269
- Other	43	30	82	61	32	42	67
Subtotal	318	397	574	299	161	257	336
c. Australia & New Zealand	117	143	133	112	148	139	189
d. Africa	44	25	36	44	42	40	28
e. Western Europe	70	37	24	59	13	76	160
3. TOTAL SALES	6,474	7,169	7,115	6,430	5,051	6,557	7,068

[1] Includes small volumes of New Brunswick potash

SOURCE: Potash and Phosphate Institute

1985 April 17

extent, this reflects the difficult conditions facing American farmers in the last few years. Even sales to the US Corn Belt (composed of the States of Illinois, Iowa, Indiana, Minnesota, Ohio and Wisconsin) have faltered in recent years as follows:

1979 - 3,111,882 tonnes k_2O (42% of total sales)
1980 - 2,912,010 tonnes k_2O (41% of total sales)
1981 - 2,699,871 tonnes k_2O (42% of total sales)
1982 - 2,047,255 tonnes k_2O (41% of total sales)
1983 - 2,750,547 tonnes k_2O (42% of total sales)
1984 - 2,495,749 tonnes k_2O (35% of total sales)

Sales to offshore markets, however, rose 25 percent in 1984 and far exceeded the previous high of 1980. The Asian market has been very strong in recent years, particularly China and India while sales to Brazil are recovering following the low point reached in 1982. It is likely that sales to all "developing" countries will be affected, from time to time, by problems of financing.

To date, potash production in New Brunswick has been minimal (about 96,000 tonnes in 1984) but is expected to increase significantly both in 1985 and 1986 as the PCA mine overcomes start-up problems and the Potacan-Dennison mine gets started. Production from these mines is likely to cut into Saskatchewan markets in Ontario, Quebec and Eastern Canada as well as the eastern United States and possibly markets in Central and South America and Western Europe.

As the United States market is so vital to Saskatchewan producers, it is useful to examine the source of U.S. potash imports (shown in Table G-3)

Table G-3

UNITED STATES POTASH IMPORTS FROM OFFSHORE

(tonnes k_2O)

Country	1980	1981	1982	1983	1984
Israel	194,822	250,501	230,268	274,594	264,800
U.S.S.R	15,125	-	36,917	48,528	56,675
East Germany	35,210	41,334	23,688	111,200	53,126
West Germany	13,888	11,712	2,420	23,250	25,421
Spain	6,613	8,073	35,474	34,376	-
Other	7,326	2,928	3,841	-	7,960
TOTAL	272,873	314,547	332,608	491,949	407,982

SOURCE: United States, Potash and Phosphate Institute.

Generally, potash imports from offshore were destined for States in eastern and south-eastern U.S.A., namely, Alabama, Florida, Georgia, Louisiana, Maryland, North and South Carolina and Virginia. While distant from Saskatchewan, potash producers here have competed successfully in these markets. Sales from Saskatchewan and U.S. producers (mainly New Mexico) to this group of states in the period 1981 to 1984 were as follows:

Year	Saskatchewan Producers	U.S. Producers
	(tonnes k_2O)	
1981	487,473	318,329
1982	372,730	226,452
1983	408,170	193,537
1984	580,535	183,221

When production at New Brunswick mines gears up, that product, too, will move in to these markets but it is far from certain that Saskatchewan potash will be displaced. In New Mexico, the better potash ores have long since been mined out and production costs are much higher than those in Canada. There are further problems, caused by oil and gas drilling in New Mexico, which may have rendered the mines there "gassy." The expense of meeting federal safety standards in such mines would probably cause the operations to shut down. Furthermore, New Mexico producers have charged israel, U.S.S.R, East Germany and Spain with "dumping" potash in U.S. markets and may face countervailing duties. Thus, it does not follow that, because more potash is available from international producers, it will necessarily find its way into North American markets.

3. World Production and Consumption of Potash Fertilizer

Estimates of world production and consumption of potash fertilizers are shown in Table G-4. This is useful in that it provides an impression of the balance between production and consumption and identifies areas of surplus and deficit.

Both production and consumption rose strongly in 1983/84, by 13.9 percent and 12.1 percent, respectively. The U.S.S.R. was by far the largest producer, accounting for 33 percent of world production in 1983/84, but was also the largest consumer (24% of the world total). The volume of potash available for export from the U.S.S.R. actually declined in the last two fertilizer years and was less than half the amount available

for export in Canada in 1983/84. Furthermore, the bulk of Russian potash exports go to markets in East and West Europe. East German production has been flat for several years now and is likely to remain so but that country has been quite aggressive in export markets. West European production of potash is in a stable to declining position and is currently barely self-sufficient. In North America, Canadian production recovered well in the last fertilizer year but output from mines in the United States declined 32 percent in the last three years (though there was some recovery in calendar 1984). The North American "surplus" is lower than that of Eastern Europe but not by much.

Other areas of the world are in a deficit position in regard to potash. Asia remains a major importer of potash, and a strongly growing market, despite increased production in Israel though the new Jordanian mine will reduce the deficit when start-up problems are resolved. Latin America has little indigenous production but a small mine should be in operation later this year. It, too, is an important market but financial difficulties have necessitated a reduction in potash imports in the last few years. Finally, both Africa and Oceania currently have no indigenous production and must import all their potash requirements. Consumption in the last three or four years has been relatively flat but the "potential" in Africa is considerable.

Without question, there is a great need for fertilizers of all kinds in the developing world. What is lacking is education in farming methods and the means for purchasing fertilizers.

Table G-4

WORLD PRODUCTION AND CONSUMPTION OF POTASH FERTILIZERS, FERTILIZER YEARS

(thousands of tonnes k_2O)

	Production			Consumption			Difference		
	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84	1981/82	1982/83	1983/84
North America	8,006	7,018	8,625	5,458	4,733	5,655	2,548	2,285	2,970
- Canada	6,043	5,379	7,156	352	355	390	5,691	5,024	6,766
- United States	1,963	1,639	1,469	5,106	4,378	5,265	(3,143)	(2,739)	(3,796)
Eastern Europe	11,909	11,513	12,725	8,527	8,258	9,552	3,382	3,255	3,173
- U.S.S.R.	8,449	8,079	9,294	4,905	4,991	6,201	3,544	3,088	3,093
- East Germany	3,460	3,434	3,431	602	497	424	2,858	2,937	3,007
- Remainder	-	-	-	3,020	2,770	2,927	(3,020)	(2,770)	(2,927)
Western Europe	5,136	4,920	5,352	4,970	5,174	5,291	166	(254)	61
Asia	856	980	1,139	2,751	2,517	3,044	1,895)	(1,537)	(1,905)
- China	24	25	29	575	394	700	(551)	(369)	(671)
- India	-	-	-	670	622	627	(670)	(622)	(627)
- Japan	-	-	-	535	582	632	(535)	(582)	(632)
- Israel	832	946	942	25	21	20	807	925	922
- Jordan	-	9	168	2	1	1	(2)	8	167
- Remainder	-	-	-	944	897	1,064	(944)	(897)	(1,064)
Central & South America	14	5	-	1,301	1,386	1,298	(1,285)	(1,381)	(1,298)
- Brazil	-	-		767	876	727	(767)	(876)	(727)
Africa	-	-		411	400	372	(411)	(400)	(372)
Oceania	-	-	-	255	254	260	(255)	(254)	(260)
WORLD TOTAL	25,921	24,436	27,841	23,673	22,721	25,472	2,248	1,715	2,369

SOURCE: British Sulphur Corporation, Phosphorus & Potassium, No. 135, January-February, 1985.

1985 April 17

4. Recent and Forthcoming Developments in Potash Mining

a. Saskatchewan

Estimated capacity at Saskatchewan mines in 1984 was roughly as follows:

	Thousands of Tonnes K_2O
Potash Corporation of Saskatchewan	
- Cory	649
- Rocanville	1,054
-Lanigan	624
-Allan (plus Kidd Creek)	858
International Minerals & Chemical Corporation	2,324
Central Canada	775
Cominco	664
PCA	639
Sub-total Conventional Mines	7,587
Kalium Chemicals	886
TOTAL ALL MINES	8,473

The above represents "designated capacity" and does not necessarily indicate production capability. Two expansions are underway at present with Kalium raising its capacity by about 25 percent by late-1986 and Lanigan expanding to about 2 million tonnes capacity by late-1985. Central Canada may expend its capacity to be operational by the end of the decade. By the end of 1986, Saskatchewan could have a productive capacity of 10 million tonnes K_2O.

Another new mine could be developed in the early 1990's but there could be competition from Manitoba where a joint development with Chinese authorities is possible.

b. New Brunswick

PCA encountered start-up problems at its mine in 1984 but is expected to be an annual production level of about 400,000 tonnes K_2O in 1985 and eventually 562,000 tonnes.

The Denison-Potacan mine could be in production towards the end of this year with an ultimate capacity of about 800,000 tonnes k_2O. Both mines are close to port facilities which gives them a distinct freight advantage over Saskatchewan mines though production costs are likely considerably higher. Markets will be sought chiefly in Eastern Canada, Eastern United States, Latin America and Western Europe though some penetration into African and Asian markets is also possible. A third potash mine is rated a "possibility" by the end of the 1980's.

c. United States

Potash mining in New Mexico is facing several problems--depletion of the better grades, rising production costs, increased competition from Canadian and offshore producers and the possibility that mines might be declared "gassy", necessitating significant capital investment or, alternatively, abandonment. It has been reported that most of the mines in New Mexico are for sale and the future of potash mining there is far from secure.

There are flooding problems at the Utah mine of Great Salt Lake Minerals and that operation may be out of production for up to three years. An interesting possible future development is the test undertaken by Kalium Chemicals for a solution mine in Michigan.

d. Jordan

The emergence of Jordan as a significant producer of potash is significant in that most of the output is dedicated to the export market. Production in 1984 fell well below expectations but once start-up problems are resolved, output from this mine will provide competition for established suppliers in markets all over the world. By 1990, Jordanian exports could total 700,000 tonnes k_2O.

e. Israel

Expansions in 1982 and 1984 have raised potash production capacity to a current level of about 1.2 million tonnes k_2O. Exports to the United States have been climbing but may face countervailing duties in the light of dumping charges.

f. Eastern Europe

This area remains the largest producer of potash in the world but the bulk of production is for domestic requirements and fears of flooding world markets to earn hard currencies have not materialized. In the U.S.S.R., chronic transportation problems, severe climate conditions and various logistical problems have hampered the development of the industry. Although about 30 percent of Russian production is exported, most of it is to Eastern Europe or Western Europe. No new mines are to be constructed during the twelfth five-year plan with efforts concentrated on expanding and improving existing facilities.

The levels of production and exports from East Germany have been virtually flat for the last eight years and few changes are expected in the next ten years or so. Some market penetration in Latin America has been possible through the conclusion of barter agreements.

g. Developing Countries

Brazil should join the ranks of potash producers in 1985 but output will be quite modest and the bulk of potash requirements will continue to be met with imports. China produces small quantities of potash (about 30,000 tonnes k_2O) and is developing a brine extraction plant, but will remain a major importer of potash for many years to come (possibly up to 1 million tonnes k_2O). Thailand possesses large reserves of potash but commercial development is not expected before the late 1990's.

5. Forecasted World Demand for Potash

World consumption of potash fertilizers recovered well in 1983/84 but most of the growth potential in future years appears to lie in Eastern Europe (which is more than self-sufficient in potash), Asia and Latin America. In North America, potash consumption seems to have peaked in 1980 and may not return to that level for several years to come given the current world prices for grains and the level of indebtedness among American farmers. West European consumption is at a mature stage promising little growth. This suggests that potash producers will be forced to look

Table G-5

FORECAST OF POTASH PRODUCTION AND CONSUMPTION (CHASE ECONOMETRICS)

(thousands of tonnes K_2O)

	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	% Change 1985-1993
NORTH AMERICA										
- Production	9,448	9,546	9,649	10,003	10,456	10,694	10,862	11,061	11,322	19.8
- Consumption	6,350	6,604	6,836	7,150	7,036	7,259	7,441	7,251	7,674	20.9
- Balance	3,098	2,942	2,813	2,853	3,420	3,435	3,421	3,810	3,658	
EASTERN EUROPE & USSR										
- Production	12,995	13,916	14,807	15,352	16,017	16,622	17,157	17,551	18,202	40.1
- Consumption	9,474	10,212	10,461	10,834	11,211	11,548	11,766	12,194	12,420	31.1
- Balance	3,521	3,704	4,346	4,518	4,806	5,074	5,391	5,357	5,782	
WESTERN EUROPE										
- Production	5,106	5,328	5,308	5,319	5,323	5,333	5,344	5,358	5,369	5.2
- Consumption	5,520	5,903	6,188	6,214	6,236	6,254	6,276	6,295	6,312	14.3
- Balance	(414)	(575)	(880)	(895)	(913)	(921)	(932)	(937)	(943)	
ASIA & OCEANIA										
- Production	1,286	1,402	1,452	1,487	1,510	1,543	1,619	1,697	1,769	37.6
- Consumption	3,704	4,072	3,858	4,068	4,269	4,438	4,647	4,844	5,048	36.3
- Balance	(2,418)	(2,670)	(2,406)	(2,581)	(2,759)	(2,895)	(3,028)	(3,147)	(3,279)	
CENTRAL & SOUTH AMERICA										
- Production	85	199	237	283	295	312	330	342	354	-
- Consumption	1,712	1,989	2,238	2,556	2,897	3,063	3,230	3,341	3,499	104.4
- Balance	(1,627)	(1,790)	(2,001)	(2,273)	(2,602)	(2,751)	(2,900)	(2,999)	(3,145)	
AFRICA										
- Production	-	-	-	-	-	-	-	-		
- Consumption	487	511	530	550	570	589	604	616	628	29.0
- Balance	(487)	(511)	(530)	(550)	(570)	(589)	(604)	(616)	(628)	
WORLD										
- Production	28,920	30,391	31,452	32,444	33,601	34,504	35,312	36,008	37,016	28.0
- Consumption	27,247	29,290	30,111	31,372	32,219	33,151	33,964	34,541	35,581	30.6
- Balance	1,673	1,101	1,341	1,072	1,382	1,353	1,348	1,467	1,435	

1985 April 24

increasingly to offshore markets. Potash requirements in the Third World are large and growing but, unless aid programs are stepped up, demand is likely to be erratic, depending upon economic and financial conditions. In aggregate, the developing countries do not yet constitute a major factor in world potash consumption but the market is growing swiftly and competition to fill import needs will be keen.

Table G-5 shows a forecast of world potash production and consumption, 1984/85 to 1992/93, from Chase Econometrics (1984 October and 1984 December). Saskatchewan Power Corporation does not necessarily agree with the forecast but it does provide an indication of probable growth over the next nine fertilizer years. World consumption of potash climbs 31 percent being particularly strong in Latin America (up 104%), Asia and Oceania (up 36%) and Eastern Europe (up 31%). The "mature" users of North America and Western Europe increase consumption only modestly in the period. Production rises 50 percent in the U.S.S.R. but less than 20 percent in North America.

6. Saskatchewan Potash Sales Related to World Consumption

Table G-6 provides a historical picture of Saskatchewan potash sales and shares of world markets in the last eight fertilizer years. The province's share of world markets has ranged from a low of 22 percent in 1982/83 to a high of 29 percent in 1980/81 but has averaged about 26 percent.

Saskatchewan producers have been dominant in North American markets with a share of about 74 percent. Some of this share will be lost to producers in New Brunswick over the next few years but U.S. domestic production will probably continue to decline and Saskatchewan will remain the dominant supplier. Saskatchewan has been the principal supplier to Asian markets (about 52% of the total), too, but will face increasing competition in the future, particularly from Jordan. Saskatchewan sales to Latin American markets have ranged from 31 percent of total to 6 percent and producers will have to work to remain competitive. Saskatchewan is the principal supplier to Oceania (Austraila and New Zealand), too, but that market is expected to remain relatively flat.

Table G-6

POTASH CONSUMPTION AND SASKATCHEWAN POTASH SALES, FERTILIZER YEARS

(thousands of tonnes k_2O)

	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
NORTH AMERICA								
- Consumption[1]	6,281	5,935	6,474	6,689	6,805	5,904	5,497	6,193
- Saskatchewan Sales	4,630	4,712	4,756	5,032	4,970	4,251	3,637	4,651
- %	73.7	79.4	73.5	75.2	73.0	72.0	66.2	75.1
ASIA								
- Consumption	1,761	1,904	2,291	2,520	2,442	2,772	2,544	2,887
- Saskatchewan Sales	717	1,046	1,230	1,147	1,566	1,225	1,253	1,766
- %	40.7	54.9	53.7	45.5	64.1	44.2	49.3	61.2
LATIN AMERICA								
- Consumption	1,125	1,390	1,482	1,587	1,860	1,307	1,397	1,421
- Saskatchewan Sales	154	235	387	458	472	74	141	339
- %	13.7	16.9	26.1	28.9	30.8	5.7	10.1	23.9
OCEANIA								
- Consumption	241	234	258	242	238	257	229	253
- Saskatchewan Sales	54	89	146	135	112	151	124	168
- %	22.4	38.0	56.6	55.8	47.1	58.7	54.1	66.4
AFRICA								
- Consumption	335	365	363	353	397	445	426	472
- Saskatchewan Sales	21	27	28	32	50	46	35	35
- %	6.3	7.4	7.7	9.1	12.6	10.3	8.2	7.4
WORLD								
- Consumption	23,677	23,558	24,921	24,610	24,970	24,188	23,601	25,640
- Saskatchewan Sales	5,594	6,181	6,615	6,846	7,306	5,759	5,240	7,121
- %	23.6	26.2	26.5	27.8	29.3	23.8	22.2	27.8

[1] Includes non-agricultural consumption.

SOURCE: Chase Econometrics, U.S. & World Fertilizer Service (1984 December) for consumption estimates, Saskatchewan Sales from The Potash and Phosphate Institute.

1985 April 17

It seems certain that, with new producers in favourable locations (Jordan, New Brunswick) coming onto the potash market with output largely dedicated to exports, Saskatchewan producers will be hard pressed, in the next few years, to retain their share of world markets. The forecast of Saskatchewan production attempts to recognize these factors.

7. Forecast of Saskatchewan Production

The 1985 forecast starts from a much higher base than had been indicated at this time last year owing to the record level of production in 1984. The pattern of growth will therefore be significantly different from that forecasted last year.

Most forecasters believe that production in Saskatchewan will fall back from its 1984 level in the next two or three years owing mainly to increasing competition and the high level of inventories (1.5 million tonnes k_2O) at Saskatchewan mines. Nevertheless, production has been maintained at a high level in the early months of 1985 and sales have kept pace. There is the possibility that production will continue to be constrained at the new facilities in New Brunswick and Jordan and that U.S. production will fall again, in which case Saskatchewan output could stay close to last year's level. For these reasons, a range of potash production is provided.

Year	Low Forecast	Most Likely	High Forecast
	(thousands of tonnes k_2O)		
1985	6,800	7,732	7,800
1986	7,000	7,838	7,900
1987	7,200	8,048	8,100
1988	7,500	8,263	8,300
1989	7,650	8,589	8,700
1990	7,800	8,590	8,700
1991	7,950	8,590	8,800
1992	8,100	8,600	8,900
1993	8,300	8,800	9,300
1994	8,500	9,100	9,500
1995	8,600	9,300	9,900
2000	9,400	10,550	11,800
2005	10,200	11,900	13,600

It must be recognized that a great deal of uncertainty exists in a forecast of this nature. Forecasts beyond 1995 are particularly speculative though probably on the low side, assuming that world population continues to grow and that potash production at the older European and United States mines is gradually phased out.

H. SODIUM SULPHATE

1. Production and Sales

Production and sales of sodium sulphate from Saskatchewan mines over the last ten years are shown in Table H-1.

Table H-1

PRODUCTION AND SALES OF SODIUM SULPHATE

Year	Production	Sales	Average Price
	(tonnes)		($)
1974	564,354	562,789	25.11
1975	422,411	415,005	47.51
1976	416,898	416,900	50.57
1977	371,038	362,829	51.79
1978	334,833	331,301	52.64
1979	394,979	401,024	57.71
1980	440,523	437,318	62.53
1981	500,028	498,189	73.04
1982	509,553	511,396	85.33
1983	415,309	413,183	94.00
1984 est.	352,293	348,911	98.11

SOURCE: Saskatchewan Energy and Mines, Mineral Statistics Yearbook, for data from 1974 to 1983.

Generally speaking, production and sales are at about the same level. Both declined sharply over the last two years and production in 1984 was more than 30 percent below the level achieved in 1982. Nevertheless, the average price held up and even increased moderately in 1984.

2. Forecast

Sodium sulphate is a counter cyclical industry which fares quite well when industries which produce sodium sulphate as a by product are in recession. But competition from other

products is increasing in both the pulp and paper and detergent industries and newer uses, as a heat storage medium in solar heating projects and mixes with potash to produce potassium sulphate, are modest at best.

It is likely that production will remain at about 350,000 tonnes in 1985 with some recovery to 400,000 tonnes over the next two or three years. It is unlikely, however, that production will again surpass 500,000 tonnes.

I. MANUFACTURING

1. Total Value of Shipments

Preliminary estimates from Statistics Canada suggest that the value of goods manufactured in Saskatchewan rose by 10.2 percent in 1984. In constant dollar terms, the increase was about 5.9 percent. Estimates for the last ten years, in current and constant dollars, are shown in Table I-1. The deflator is the composite Industry Selling Price Index.

Table I-1

VALUE OF MANUFACTURING SHIPMENTS IN CURRENT AND CONSTANT DOLLARS, SASKATCHEWAN, 1974 TO 1984

Year	Value in Current Dollars ($ million)	% Change	Value in 1971 Dollars ($ million)	% Change
1974	1,045	19.0	757	8.5
1975	1,176	12.5	765	1.1
1976	1,213	3.1	751	(1.8)
1977	1,299	7.1	745	(0.8)
1978	1,514	16.6	795	6.5
1979	1,863	23.0	855	7.5
1980	2,118	13.7	857	0.2
1981	2,504	18.2	919	7.2
1982	2,488	(0.6)	877	(4.6)
1983	2,466	(0.9)	825	(5.9)
1984 prelim.	2,718	10.2	874	5.9
1974 to 1984		160.1		15.5
Annual Rate		10.0		1.4

It should be noted that the constant dollar estimate is very rough and intended only as a very general indicator of physical output. On this basis, however, real growth has been uneven over the last ten years averaging 1.4 percent over the period but only 0.4 percent over the last five years.

2. General Outlook

The short-term outlook is tied quite closely to the oil industry. The hectic pace of oil and gas well drilling over the last two years benefited the province's steel industry considerably and should continue on to do so as long as incentive programs are in place. In the next few years, much will depend upon whether or not one or both of the heavy oil upgraders proceeds. On the assumption that both will go forward, the Planning Bureau forecasts high levels of investment in manufacturing ($636 million in constant 1971 $) in the period 1985 to 1989. At present, the New Grade up grader, at Regina, is scheduled to be on stream in 1988 or 1989 with a capacity to process 8,000 m^3/day. The Husky upgrader, at Lloydminster is expected to start production in 1989 with a capacity of about 8,600 m^3/day.

The Conference Board's forecast of Saskatchewan's real GDP shows manufacturing advancing slowly in the next four years (2.6% annually) following last year's strong growth.

2. Steel

The steel industry in Saskatchewan continued to improve its production record in 1984 as ingot production rose to 546,000 tonnes; more than 40 percent above the 1983 level of 389,000 tonnes. There were significant increases in demand for oil country tubular goods and IPSCO made sales in both Canada and the United States despite stiff competition from offshore suppliers who took advantage of low cost production and high North American currencies to raise their market share to 40 percent. Also, for the first time since 1982, modest quantities of large diameter spiral pipe were produced for gas transmission lines.

The outlook depends upon the health of the oil and gas industry in North America, the buoyancy of the North American economies and continued access to the U.S. market and the ability of IPSCO to compete with low-priced imports. Oil and gas well drilling has been setting new records in the first three months of 1985, at least in Saskatchewan, and should remain strong at least until the end of the year. With the expectation of larger gas exports there should be a need to reinforce the gas transmission infrastructure and demand for large diameter pipe should climb substantially in 1986. IPSCO continues to diversify its products and sales of flat rolled steel have continued to increase.

Saskatchewan's steel industry recovered well in the last two years and growth in the next few years will probably be much more modest. Should the heavy oil upgraders proceed, however, demand for structural steel and tubular steel presumably would rise substantially.

4. Pulp and Paper

Pulp production in Saskatchewan increased 20 percent in 1984 to a level of 264,351 tonnes. For the pulp and paper industry in Canada as a whole, 1984 was a good year but inadequate profits in recent years have stunted the capital investment needed if the industry is to remain competitive in the face of low-priced imported products, particularly from Scandinavia.

Owing to fierce competition and oversupply conditions, the short-run outlook in Saskatchewan is not too promising but a new paper mill in the Prince Albert area is a possibility while, in the longer term, the development of the province's aspen resources is probable as technology advances. The latter development would create significant requirements for electricity.

J. COMMERCIAL

1. General

The commercial sector of the economy is assumed to be represented by the service-producing industries as shown in estimates of Real Domestic Product (RDP), published by The Conference Board. In general, the term is intended to cover educational and health institutions, office buildings, banks and financial houses, retail and wholesale outlets, shopping malls, grain elevators, hotels, restaurants, service stations, theatres, cinemas, sports arenas, and other similar enterprises. In SPC data and forecasts, a number of small industrial customers are included in the commercial category.

In the absence of a good database and a reliable methodology for forecasting the commercial sector of the economy, SPC's load forecast relates demand for energy to estimates of Real Domestic Product and employment.

2. Real Domestic Product

Between 1974 and 1984, according to estimates prepared by The Conference Board, the service sector RDP in Saskatchewan rose by 39 percent or 3.3 percent annually. The strongest sectors in this period were finance, insurance, and real estate followed by transportation, storage, and communication.

The medium-term forecast from The Conference Board looks for continued growth in the next five years but at a slower pace, averaging 2.17 percent annually. Informetrica forecasts stronger growth in this period, averaging about 3 percent but slowing to 2.1 percent per year in the period 1990 to 2005. Although the Economic Council of Canada last year described the service sector as "a major vehicle of economic growth," SPC's forecast is more conservative, averaging 1.8 percent in the next ten years and 1.6 percent between 1995 and 2005.

3. Employment

In the last ten years the commercial sector experienced relatively strong growth in employment, averaging about 3.4 percent. As the labour force grows and the economy diversifies and matures, more and more people find employment in the service industries. In recent years, many jobs have been created in areas such as finance, real estate, warehousing, and commercial services (accommodation and food, personal services, services to business management, amusement and recreation, etc.), but there may be limits to growth opportunities given the expected moderate to slow population growth. Again, Informetrica is bullish, forecasting annual growth of 3.1 percent in employment in commercial and personal services between 1985 and 1989, slowing to 2.1 percent in the period 1990 to 2005. SPC's forecast is more cautious, looking for 1.5 percent annual growth in the next ten years and 1.2 percent in the subsequent ten-year period, 1995 to 2005. This is consistent with the slower growth in labour force forecasted by the Planning Bureau and a more stable participation rate, coupled with the aging of the workforce.

K. LOAD FORECASTING WITH A PROBABILISTIC MODEL

1. INTRODUCTION

Each year Forecasting and Economic Analysis produces a twenty-year load forecast of electricity and natural gas requirements. The forecast is a single estimate for each year based upon what is viewed as the current most likely outlook for those factors which determine future demand. It is unfortunate that single deterministic load forecasts (such as those traditionally produced by utilities) create the illusion of precision since history has shown that it is impossible to predict the future exactly. The future is fuzzy and uncertain as opposed to deterministic, and forecasts can reflect this by showing a band, range, or interval rather than a single estimate. This report discusses ways in which this can be done and describes the method and inputs used to produce the high and low forecasts used in the 1984 Load Forecast.

2. METHODS USED TO DETERMINE FORECAST UNCERTAINTY

A common requirement of the methods used to determine forecast uncertainty is to have a model or mathematical description of future demand as a function of a number of explanatory variables. For example:

$$D = f(x_1, x_2, \ldots, x_n)$$

A common approach used to describe uncertainty is the scenario approach. Using this method pessimistic, most likely, and optimistic forecasts are produced. High, median, and low estimates for each explanatory variable x_1 are combined using the forecast model or equation. This method produces a range of possible outcomes but since probabilities of occurrence are not normally assigned, uncertainty is not quantified.

Two methods which quantify uncertainty are the Probability Tree method and the Monte Carlo method. The Probability Tree method employs a number of discrete points to approximate the probability[1] distributions of the explanatory variables.

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[1]Probabilities can be viewed as weights assigned to events where the weights indicate a personal belief regarding the outcome of events. Probabilities can be estimated in one of two ways. Either a sample is available from which to objectively estimate the probability, or the probability is a subjective feeling about the truth of some proposition. Subjective feelings arise from whatever knowledge a person has about a situation.

As a general rule, probability distributions are discretized into an upper 15 percent portion, a lower 15 percent portion, and a middle 70 percent portion. Using this approach, the high and low values each have a 15 percent chance of occurring while the median value has a 70 percent chance. Next, the future can be thought of as a probability tree with each route through the branches as one possible scenario (see the following illustration). Finally, the model can be used to produce demand forecasts based upon the value for explanatory values along each possible route. The probability of occurrence for each case is determined by using the multiplicative probability[2] rule. Using this method, a forecast probability curve can be approximated. Note, however, that this exercise can become quite unwieldy as the number of explanatory variables and therefore probability branches increase.

The final method for determining forecast uncertainty is the Monte Carlo method. This method is very similar to the Probability Tree method except that probability distributions for the component explanatory variables are continuous .random variables rather than discrete. In general terms, the computer is used to randomly select values for each explanatory variable in such a way that the probability of selecting these values is defined by their probability distributions. For each set of randomly selected explanatory variables, a demand forecast is produced using the forecasting model. This process is done a large number of times (500 - 1,000 trials) and a frequency distribution is produced from the resulting forecast which is used to estimate the forecast probability distribution.

3. ESTIMATED PROBABILITY DISTRIBUTION FOR THE FORECAST OF ELECTRICAL ENERGY AND PEAK LOAD REQUIREMENTS

The Monte Carlo method was used to estimate the probability distribution for forecast electrical requirements.[3] Two assumptions were made:

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[2]If the probability of event A is P(A) and the probability of event B is P(B) then the probability of them both happening is $P(A) \cdot P(B)$ provided both events are independent (i.e., the outcome of one event in no way affects the outcome of the other). If A and B are dependent events then this must be taken into account when determining their joint probability. (i.e, $P(A \& B) = P(A/B) \cdot P(B)$ where $P(A/B)$ is the conditional probability of event A happening given that event B does occur.)

[3]This method was chosen because it provides a method to quantify uncertainty, and because a computer program could be written with relative ease.

APPLICATION OF THE PROBABILITY TREE METHOD FOR ANALYZING UNCERTAINTY

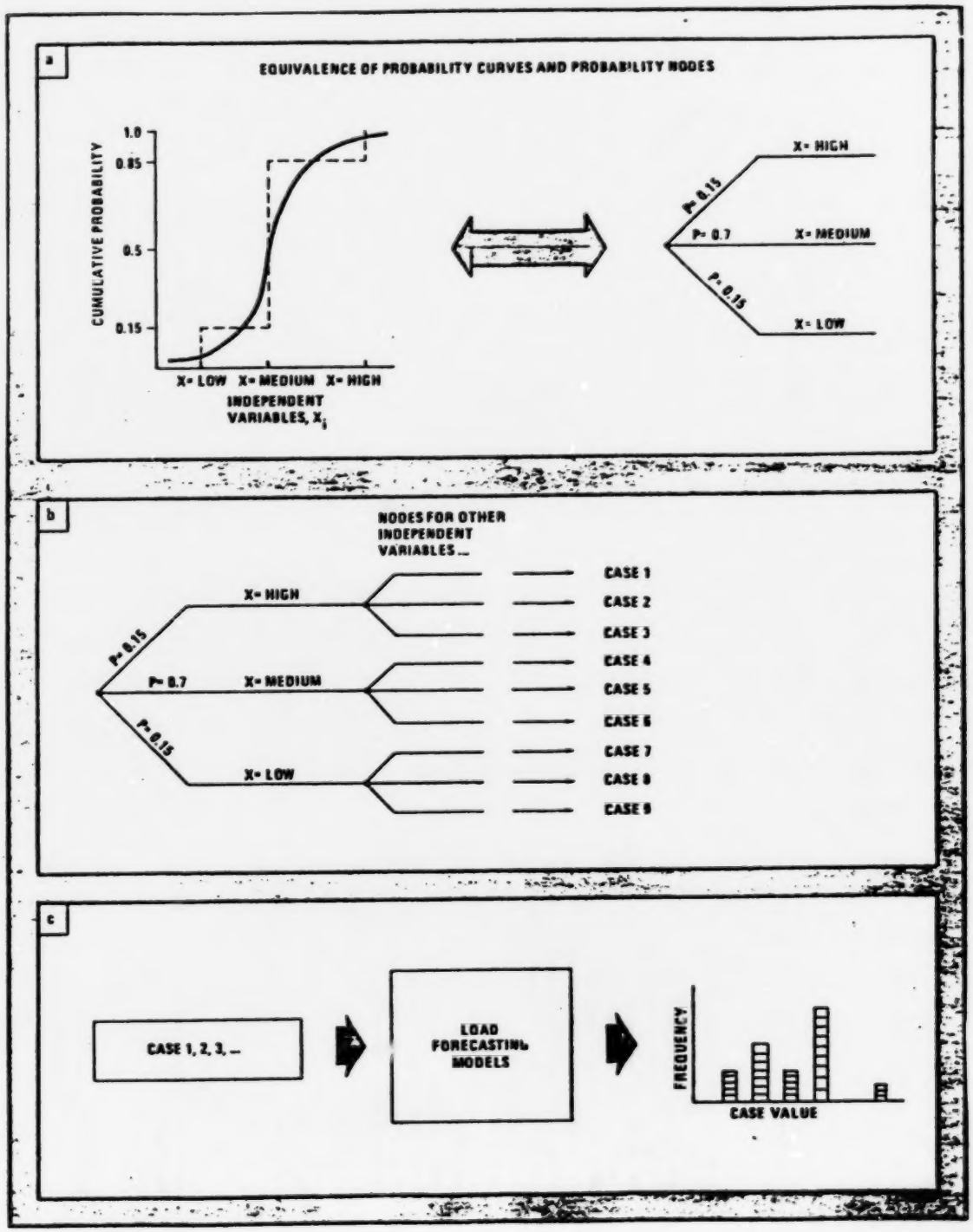

Table I (a)

ELECTRICITY - PROBABILITY ANALYSIS

Variable	1985			1986			1990		
	E(x)	δ(x)	δ(x)/E(x) (%)	E(x)	δ(x)	δ(x)/E(x) (%)	E(x)	δ(x)	δ(x)/E(x) (%)
Cumulative net increase in customers Since 1982 (thousands)	19.4	2.0	10.3	23.9	4.0	16.7	41.9	8.0	19.1
MW/residential customer	7.673	0.2	2.6	7.783	0.2	2.6	8.211	0.4	4.9
Farms with residence (thousands)	52.9	1.0	1.9	52.2	1.5	2.9	49.4	3.0	6.1
MW.h/farm residence excl. electric space heating	12.4	0.3	2.4	12.5	0.3	2.4	13.1	0.5	3.8
Farm with electric space heating (thousands)	6.6	0.3	4.5	7.0	0.6	8.6	8.6	1.0	11.6
MW.h/farm electric space heating	36.0	3.0	8.3	36.0	3.0	8.3	36.0	5.0	13.9
Farm commercial consumption (GW.h)	517.9	25.0	4.8	539.5	25.0	4.6	639.3	50.0	7.8
Street lighting (MW.h)/residential customer	0.232	0.01	4.3	0.233	0.01	4.3	0.238	0.02	8.4
G.S: 2-5 Std. (MW.h)/residential customer	9.08	0.5	5.5	9.3	0.5	5.4	10.08	1.0	9.9
Potash production excl. Kalium (10^6 tonnes)	6.8	0.25	3.7	6.8	0.3	4.4	7.4	0.3	4.1
Potash kW.h/tonne	175.0	15.0	8.6	175.0	15.0	8.6	175.0	20.0	11.4
IPL throughput (10^6 m^3)	56.9	2.4	4.2	58.4	2.4	4.1	54.5	3.5	6.4
IPL throughput kW.h/m^3	10.3	1.0	9.7	10.4	1.0	9.6	11.0	2.0	18.2
IPSCO consumption (GW.h)	439.0	50.0	11.4	444.0	50.0	11.3	553.6	100.0	18.1
Other existing G.S. 6 (GW.h)	517.7	25.0	4.8	548.9	25.0	4.6	717.3	50.0	7.0
Weyburn/Estevan area oil production (10^6 m^3)	4.5	0.1	2.2	4.6	0.2	4.3	4.3	0.2	4.7
Weyburn/Estevan area kW.h/m^3	49.0	5.0	10.2	51.7	5.0	9.7	62.5	5.0	8.0
Lloydminster area oil production (10^6 m^3)	3.0	0.2	6.7	3.2	0.2	6.3	3.6	0.4	11.1
Lloydminster area kW.h/m^3	19.1	5.0	26.2	20.4	5.0	24.5	30.8	5.0	16.2
Swift Current area oil production (10^6 m^3)	1.6	0.2	12.5	1.6	0.2	12.5	1.4	0.2	14.3
Swift Current area kW.h/m^3	51.0	5.0	9.8	53.4	5.0	9.4	62.9	5.0	7.9
Kindersley area oil production (10^6 m^3)	2.1	0.2	9.5	2.5	0.3	12.0	2.5	0.3	12.0
Kindersley area kW.h/m^3	30.6	5.0	16.3	33.0	5.0	15.2	38.0	5.0	13.2
Speculative load (GW.h)	48.0	10.0	20.8	48.0	10.0	20.8	223.0	223.0	100.0
SPC Use (GW.h)	68.2	5.0	7.3	66.5	5.0	7.5	70.9	10.0	14.1
Saskatoon Bulk (GW.h)	850.0	20.0	2.4	877.0	20.0	2.3	972.8	50.0	5.1
Swift Current Bulk (GW.h)	99.6	5.0	5.0	101.4	5.0	4.9	108.7	10.0	9.2
NSEL (GW.h)	80.5	5.0	6.2	84.0	5.0	6.0	98.9	10.0	10.1
Loss Factor	0.125	0.02	16.0	0.12	0.02	16.7	0.12	0.02	16.7
Load Factor	0.603	0.03	5.0	0.6	0.03	5.0	0.6	0.03	5.0

NOTE: E(x) - expected value
δ(x) - standard error

Table I (b)

ELECTRICITY - PROBABILITY ANALYSIS

Variable	1995 E(x)	1995 δ(x)	1995 δ(x)/E(x) (%)	2005 E(x)	2005 δ(x)	2005 δ(x)/E(x) (%)
Cumulative net increase in customers Since 1982 (thousands)	57.9	12.0	20.7	87.9	20.0	22.8
MW/residential customer	8.615	0.5	5.8	9.184	1.0	10.9
Farms with residence (thousands)	46.5	4.0	8.6	42.8	5.0	11.7
MW.h/farm residence excl. electric space heating	13.5	0.6	4.4	14.3	1.2	8.4
Farm with electric space heating (thousands)	10.1	2.0	19.8	12.1	5.0	41.3
MW.h/farm electric space heating	36.0	8.0	22.2	36.0	12.0	33.3
Farm commercial consumption (GW.h)	724.7	100.0	13.8	775.6	150.0	19.3
Street lighting (MW.h)/residential customer	0.248	0.025	10.1	0.267	0.03	11.2
G.S. 2-5 Std. (MW.h)/residential customer	11.06	1.5	13.6	12.26	2.0	16.3
Potash production excl. Kalium (10^6 tonnes)	8.05	0.55	6.8	10.5	1.5	14.3
Potash kW.h/tonne	175.0	25.0	14.3	175.0	30.0	17.1
IPL throughput (10^6 m^3)	55.0	4.0	7.3	50.8	5.8	11.4
IPL throughput kW.h/m^3	11.0	2.5	22.7	10.0	3.0	30.0
IPSCO consumption (GW.h)	666.2	100.0	15.0	666.2	100.0	15.0
Other existing G.S. 6 (GW.h)	717.3	75.0	10.5	717.3	100.0	13.9
Weyburn/Estevan area oil production (10^6 m^3)	4.5	0.4	3.7	3.8	0.8	21.1
Weyburn/Estevan area kW.h/m^3	76.1	10.0	13.1	103.1	20.0	19.4
Lloydminster area oil production (10^6 m^3)	3.7	0.7	18.9	3.3	0.8	24.2
Lloydminster area kW.h/m^3	45.0	10.0	222.2	65.3	20.0	30.6
Swift Current area oil production (10^6 m^3)	1.3	0.3	23.1	0.9	0.3	33.3
Swift Current area kW.h/m^3	74.7	10.0	13.4	98.4	20.0	20.3
Kindersley area oil production (10^6 m^3)	2.2	0.4	18.2	1.5	0.4	26.7
Kindersley area kW.h/m^3	41.0	10.0	24.4	58.0	20.0	34.5
Speculative load (GW.h)	223.0	223.0	100.0	1,113.0	1,113.0	100.0
SPC Use (GW.h)	70.6	15.0	21.3	65.0	20.0	85.6
Saskatoon Bulk (GW.h)	1,074.0	75.0	7.0	1,309.2	100.0	7.6
Swift Current Bulk (GW.h)	117.8	15.0	12.7	136.0	20.0	14.7
NSEL (GW.h)	112.9	15.0	13.3	142.1	20.0	14.7
Loss Factor	0.12	0.02	16.7	0.12	0.03	25.0
Load Factor	0.6	0.03	5.0	0.6	0.03	5.0

NOTE: E(x) - expected value
δ(x) - standard error

a. explanatory variables are assumed to be independent of each other, and

b. the probability distribution for each explanatory variable is assumed to be normal.

The following equations describe the model used to forecast electrical requirements (see Table 1 for a listing of the explanatory variables);

```
Forecast (GW.h) =   [(244+x1) * x2 + (x3*x4) + (x5*x6) + x7
                     +(244+x1) * x8 + (244+x1) * x9 + (x10*x11)
                     + (x12*x13) + x14 + x15 +(x16*x17)
                     + (x18*x19) + (x20*x21) + (x22*x23) + x24
                     + x25 + x26 + x27 + x28] / (1-x29)

Peak (MW)  = Forecast (GW.h) / (8.76*x30)
```

The probability distribution for each explanatory variable can be defined abstractly in terms of its expected value and its standard deviation. Table 1 lists these parameters as they have been estimated for each of the years 1985, 1990, 1995, and 2005.

A forecast frequency curve was generated using a computer program which generated 750 forecasts using the Monte Carlo technique. Table 3 describes the resulting estimated probability distributions for forecast electrical energy and peak load. Table 2 summarizes some key parameters of these probability distributions.

Table 2

ELECTRIC FORECAST PROBABILITY DISTRIBUTION - KEY PARAMETERS

	Peak Load (MW)			Energy (GW.h)		
Year	E(x)	δ(x)	C.V.(%)	E(x)	δ(x)	C.V.(%)
1985	2,199	130	5.9	11,600	346	3.0
1990	2,635	179	6.8	13,793	635	4.6
1995	2,906	217	7.5	15,229	844	5.5
2005	3,543	403	11.4	18,560	1,840	9.9

NOTE: E(x) denotes expected value.
δ(x) denotes standard deviation.
C.V. denotes coefficient of variations or [(x)/E(x)]*100.

The formation contained in the above table can be interpreted as follows: There is a good chance (about 70%) that the actual value will fall within one standard deviation of the expected value. Therefore, we should expect, with a reasonable level of confidence, that actual load will fall within 130, 179, 217, 403 megawatts of expected or mean forecast in the years 1985, 1990, 1995, and 2005, respectively.

Based upon Table 3, it is possible to draw the following conclusions:

a. In 1985, although there is a small chance energy requirements could fall outside these limits, it is possible to say with a fair degree of certainty that they will be between 11,149 and 12,045 GW.h. By comparison, the most likely forecast is 11,630 GW.h.

b. By 1990, there is only a small chance that peak load will exceed 2,874 MW. At the same time, there is little chance that peak load will be less than 2,405 MW. By comparison, the most likely forecast is for 2,612 MW.

c. Comparable peak loads for 1995 and 2005, respectively, are high loads of 3,184 and 4,073 MW and low loads of 2,634 and 3,048 MW. By comparison, the most likely forecasts is for 2,898 MW in 1995 and 3,524 MW in 2005.

4. ESTIMATED PROBABILITY DISTRIBUTION FOR THE FORECAST OF NATURAL GAS REQUIREMENTS

The same method and assumptions used for estimating the electrical requirements forecast probability distribution were used in estimating the probability distribution for forecast natural gas requirements.

Forecast natural gas requirements are modelled as described in the following mathematical equation (see Table 4 for a listing of the explanatory variables).

Table 3

ELECTRICITY FORECAST PROBABILITY DISTRIBUTION

Probability Load Will Be This Amount or Less	1985		1986		1990		1995		2005	
	MW	GW.h	MW	GW.h	MW	GW.h	MW	GW.h	MW	GW.h
97.5	2,466	12,225	2,586	12,673	3,006	15,130	3,336	17,100	4,301	22,249
90	2,376	12,045	2,474	12,464	2,874	14,586	3,184	16,312	4,073	20,859
80	2,304	11,907	2,408	12,308	2,787	14,351	3,092	15,874	3,901	20,127
70	2,259	11,818	2,360	12,188	2,719	14,104	3,021	15,644	3,756	19,528
60	2,220	11,698	2,326	12,081	2,670	13,969	2,954	15,409	3,625	19,054
50	2,190	11,601	2,287	11,982	2,630	13,787	2,897	15,213	3,529	18,540
40	2,161	11,497	2,254	11,894	2,586	13,638	2,846	15,037	3,412	18,024
30	2,124	11,405	2,216	11,794	2,535	13,463	2,794	14,787	3,297	17,557
20	2,089	11,299	2,175	11,683	2,474	13,246	2,718	14,532	3,201	16,980
10	2,035	11,149	2,126	11,497	2,405	12,956	2,634	14,155	3,048	16,111
2.5	1,964	10,934	2,049	11,259	2,324	12,582	2,481	13,660	2,803	15,099

NOTE: MW equals Net Recorded Peak

1985 May 14

Table 4 (a)

NATURAL GAS - PROBABILITY ANALYSIS

Variable	1985			1986			1990		
	E(x)	δ (x)	δ (x)/E(x)	E(x)	δ (x)	δ (x)/E(x)	E(x)	δ (x)	δ (x)/E(x)
			(%)			(%)			(%)
Residential customers-existing market (thousands)	216.7	1.52	0.7	220.3	1.98	0.9	236.4	4.02	1.7
10^3 m^3/Residential customers-existing market	3.82	0.13	3.4	3.81	0.19	5.0	3.78	0.27	7.2
Residential customers-new market (thousands)	0.9	0.45	50.0	1.8	0.9	50.0	5.1	1.72	55.6
10^3 m^3/Residential customers-new market	3.84	0.13	3.4	3.83	0.19	4.9	3.8	0.27	7.1
Farms-normal growth (thousands)	1.23	0.10	8.3	1.25	0.13	10.4	1.3	0.19	14.7
10^3 m^3/Farms-normal growth	9.65	0.10	1.0	9.56	0.20	2.1	9.24	0.7	7.5
Farms-gas extension program (thousands)	8.45	7.6	90.0	10.95	9.9	90.0	20.95	19.91	95.0
10^3 m^3/Farms-gas extension program	4.93	0.24	4.9	4.93	0.26	5.2	4.93	0.31	6.3
Commercial customers/residential customers Ratio-existing market	0.135	0.015	11.1	0.135	0.015	11.1	0.135	0.015	11.1
10^3 m^3/Commercial-existing market	22.89	1.28	5.6	22.68	1.38	6.1	21.84	1.68	7.7
Commercial customers-new market (thousands)	0.1	0.01	10.0	0.2	0.02	10.0	0.4	0.04	10.0
10^3 m^3)/Commercial-new market	14.31	1.40	9.8	14.24	1.52	10.7	13.98	1.89	13.5
Kalium Potash production (10^6 tonnes)	0.95	0.05	10.9	1.0	0.6	10.3	1.2	0.1	10.0
Kalium (m^3/tonne)	308.7	19.76	6.4	300.5	19.5	6.5	296.3	38.8	13.1
Potash production excluding Kalium (10^6 tonnes)	6.8	0.25	3.7	6.8	0.3	4.4	7.4	0.3	4.1
Other Potash mines (m^3/tonne)	51.5	9.63	18.7	52.6	9.94	18.9	50.4	10.18	20.2
IPSCO consumption (10^6 m^3)	41.7	6.59	15.8	48.0	7.25	15.1	60.0	8.4	14.0
PAPCO consumption (10^6 m^3)	75.0	9.98	13.3	75.0	9.98	13.3	75.0	15.0	20.0
Other existing General Service 5 (10^6 m^3)	385.9	40.5	10.5	378.2	39.71	10.5	379.7	39.87	10.5
Power Plant consumption (10^6 m^3)	130.8	129.6	99.1	114.5	107.8	94.1	172.8	142.2	82.3
SPC Head Office consumption (10^6 m^3)	0.7	0.25	35.7	0.7	0.25	35.7	0.7	0.25	35.7
Vented Gas (10^6 m^3)	0.9	0.30	33.3	0.9	0.30	33.3	0.9	0.30	33.3
Medicine Hat consumption (10^6 m^3)	216.9	20.0	9.5	216.9	20.4	9.4	216.9	19.5	9.0
Other Alberta Sales (10^6 m^3)	22.3	4.0	17.9	22.4	4.5	20.1	22.6	5.0	22.1
Speculative load (10^6 m^3)	0.0	0.0	0.0	0.0	0.0	0.0	195.1	195.1	0.0
Compressor Station ratio	1.0151	0.0002	1.3	1.0151	0.0002	1.3	1.0151	0.0003	2.0
Unaccounted For ratio	1.025	0.002	0.8	1.025	0.003	1.2	1.025	0.005	2.0

NOTE: E(x) - expected value
δ(x) - standard error

Table 4 (b)

NATURAL GAS - PROBABILITY ANALYSIS

Variable	1995			2005		
	E(x)	δ(x)	δ(x)/E(x) (%)	E(x)	δ(x)	δ(x)/E(x) (%)
Residential customers-existing market (thousands)	249.5	5.99	2.4	274.9	8.52	3.1
10^3 m^3/Residential customers-existing market	3.65	0.40	11.0	3.58	1.18	33.0
Residential customers-new market (thousands)	3.1	2.30	74.1	3.1	2.30	74.1
10^3 m^3/Residential customers-new market	3.76	0.40	10.6	3.70	1.03	27.8
Farms-normal growth (thousands)	1.35	0.24	17.9	1.43	0.33	23.1
10^3 m^3/Farms-normal growth	8.83	1.29	14.6	8.18	2.10	25.7
Farms-gas extension program (thousands)	25.0	24.20	96.8	25.0	24.2	96.8
10^3 m^3/Farms-gas extension program	4.93	0.4	8.1	4.93	0.55	11.2
Commercial customers/residential customers Ratio-existing market	0.135	0.015	11.1	0.135	0.015	11.1
10^3 m^3/Commercial-existing market	20.79	2.08	10.0	19.11	2.90	15.2
Commercial customers-new market (thousands)	0.4	0.04	10.0	0.4	0.04	10.0
10^3 m^3)/Commercial-new market	13.65	2.40	17.6	12.99	3.52	27.1
Kalium Potash production (10^6 tonnes)	1.258	0.23	18.2	1.4	0.2	16.7
Kalium (m^3/tonne)	294.1	58.82	20.0	289.6	78.19	27.0
Potash production excluding Kalium (10^6 tonnes)	8.1	0.55	6.8	10.5	1.5	9.4
Other Potash mines (m^3/tonne)	48.5	10.23	21.1	45.5	10.42	22.9
IPSCO consumption (10^6 m^3)	77.0	10.78	14.0	77.0	10.78	14.0
PAPCO consumption (10^6 m^3)	75.0	20.03	26.7	75.0	20.03	26.7
Other existing General Service 5 (10^6 m^3)	379.3	39.83	10.5	379.0	39.80	10.5
Power Plant consumption (10^6 m^3)	113.8	73.3	64.4	148.8	105.5	70.9
SPC Head Office consumption (10^6 m^3)	0.7	0.25	35.7	0.7	0.25	35.7
Vented Gas (10^6 m^3)	0.9	0.30	33.3	0.9	0.30	33.3
Medicine Hat consumption (10^6 m^3)	216.9	18.9	8.7	216.9	216.9	100.0
Other Alberta Sales (10^6 m^3)	23.8	6.24	26.2	24.5	7.33	29.9
Speculative load (10^6 m^3)	195.1	195.1	100.0	195.1	195.1	100.0
Compressor Station ratio	1.0151	0.0004	2.6	1.0151	0.0005	3.3
Unaccounted For ratio	1.025	0.007	2.8	1.025	0.008	3.2

NOTE: E(x) - expected value
δ(x) - standard error

Forecast = [(x1*x2) + (x3*x4) + (x5*x6) + (x7*x8)

+ (x1*x9*x10) + (x11*x12) + (x13*x14) + (x15*x16)
+ x17 + x18 + x19 + x20 + x21 + x22 + x23 + x24
+ x25) * x26] * x27

Table 4 lists the expected value and standard deviation which have been estimated for each explanatory variable for the years 1985, 1986, 1990, 1995, and 2005.

The following conclusions can be drawn from Table 5[4]:

a. Natural gas requirements should fall between 2,970 and 3,440 10^6 m^3 in 1985. The most likely forecast is 3,183 10^6 m^3.

b. By 1990 there is little chance that natural gas requirements will fall below 3,313 10^6 m^3 or above 4,151 10^6 m^3. The most likely forecast is 3,714 10^6 m^3.

c. Reasonable limits for natural gas requirements are 3,343 to 4,166 10^6 m^3 in 1995 and 3,315 to 4,645 10^6 m^3 in 2005. By comparison, the most likely forecast is for 3,775 and 4,000 10^6 m^3, respectively.

Table 5

NATURAL GAS FORECAST PROBABILITY DISTRIBUTION

(10^6 m^3)

Probability Load Will Be This Amount or Less	1985	1986	1990	1995	2005
97.5	3,556	3,578	4,329	4,355	5,092
90	3,444	3,453	4,151	4,166	4,645
80	3,366	3,378	4,008	4,006	4,442
70	3,308	3,325	3,929	3,914	4,252
60	3,262	3,283	3,827	3,817	4,120
50	3,217	3,244	3,741	3,746	3,991
40	3,167	3,202	3,659	3,671	3,845
30	3,115	3,155	3,560	3,585	3,689
20	3,054	3,093	3,472	3,487	3,546
10	2,970	3,010	3,313	3,343	3,315
2.5	2,831	2,897	3,060	3,132	2,956

[4]The probability distribution is based upon normal weather and does not allow for variance due to weather.

5. CONCLUDING REMARKS

The most likely forecast presents only one set of possible outcomes for the many determining variables, albeit that currently viewed as the most likely. It is quite unlikely that the future will turn out to be exactly as described by the most likely forecast. A forecast based upon a range for each of the many variables to be forecast is much more likely to bracket the actual values when the future unfolds. The results of the study described by this paper indicates that there is a fairly high probability of future load differing from the 1985 most likely forecast. However, we can provide a load interval into which we feel reasonably confident that future energy requirements are likely to fall